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I take this privilege to welcome all of you to the continuous 151st edition of International Journal of Informative & Futuristic Research (IJIFR) - Volume 13, Issue 6, February 2026. With this present issue IJIFR has successfully published more than 3450+ research papers till yet. IJIFR is a peer reviewed monthly journal that accepts research works from scholars, academicians, professors, doctorates, researchers, engineers and corporate fraternities in their respective expertise of studies. Work after publication will be available on the website (www.ijifr.org) as well as on Google Scholar based on issues of the month and its publication date as well as on other online indexing & associated websites. The Journal aims to publish quality material that contributes to accumulate dynamic knowledge which is able to revitalize and foster the research carried out in various disciplines. Its multidisciplinary approach is deliberate to bring the worldwide eminent intellectuals on one platform to illumine the world of knowledge. The journal follows a Peer Review System in order to bring in well-informed exploration for researchers across the world thereby bringing in total transparency in its journal review system. It delivers ultimate platform in order to have genuine, speculative, knowledgeable research which has the visualization to understand fact-finding experiences that describes significant developments of changing global scenarios. Respected for its International reputation, the editorial and reviewer boards of IJIFR Journal comprised of experts with not only having the academic background but also the scientists serving the various industries

Also, I express my sincerest gratitude to the all reviewer board members for their endless support to bring this issue to its present form. Undoubtedly, we could not release this issue without the remarkable efforts of our reviewers. The inspiration & knowledge of the professionals who serves as reviewers are essential to upholding technical & editorial standards. Their endless efforts and continuing support to our journal have enabled us to move into our 13th year of publication. The editors ensure that this journal will be regularly published, widely read and circulated, have high impact and attract an adequate supply of high-quality papers from an international range of authors worldwide.

Finally, I firmly believe that there is always scope for improvement & accordingly we as a team shall look forward to receive your valuable suggestions for further enriching the quality of journal.

Our Board members truly believe that you all will support us to publish original & authentic research work in near future too.

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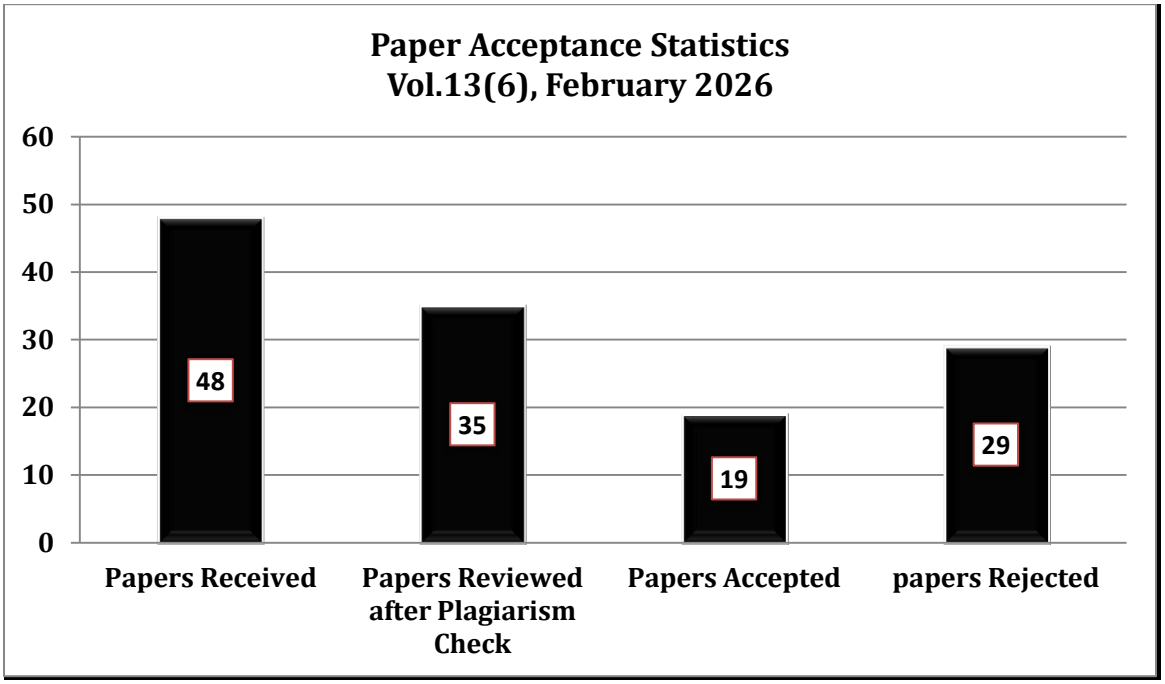

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A STUDY ON IMPACT OF 5G ON MOBILE COMMERCE IN ERODE DISTRICT

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ABSTRACT:
The rapid deployment of fifth-generation (5G) wireless technology is transforming digital ecosystems worldwide, offering unprecedented data speeds, ultra-low latency, and enhanced connectivity. This study examines the impact of 5G adoption on mobile commerce (m-commerce) in the Erode district, a growing economic hub in Tamil Nadu, India. The research investigates how 5G technology influences consumer behavior, business performance, and overall mobile transaction efficiency within the region. Primary data & Secondary data have been collected to investigate the study. In this study 100 respondents have been consided as sample from the total population in erode A study on impact of 5G on mobile commerce in Erode district of Tamil nadu, India. The study explores changes in user engagement, online purchasing trends, and the quality of digital services post-5G rollout. Final outcomes of this research study shows that by improving 5G network coverage, reducing the data costs for 5G, strengthening security protocols on 5G networks & offering more interactive features like AR product make it a promising technology for the future of mobile commerce.

KEYWORDS: ***5G Technologies, Mobile Commerce, Business Performance, Consumer behaviour***

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1. INTRODUCTION

In recent years, mobile commerce (m-commerce) has experienced exponential growth, becoming a central pillar of the digital economy. As the demand for faster, more reliable mobile experiences continues to rise, the emergence of fifth-generation (5G) wireless technology has introduced a transformative opportunity for the mobile commerce sector.5G is more than just a faster version of 4G; it is a technological leap that promises ultra-low latency, increased bandwidth, higher connection density, and enhanced network reliability. This study investigates the effect of 5G on mobile commerce, aiming to understand how its features impact user behavior, transaction efficiency, platform performance, and overall market trends

2. STATEMENT OF THE PROBLEM

This study aims to analyze the 5G technology, mobile commerce is expected to become faster and more efficient. However, there is still limited understanding of how 5G is actually affecting mobile shopping, internet speed, and user interface. Many users and companies are unsure about the real benefits and challenges of using 5G for mobile commerce. This study aims to find out how 5G is changing mobile commerce and whether it is truly improving the experience for both consumers and businesses.

3. OBJECTIVES OF THE STUDY

(i) To analyze the level of awareness about 5G technology among mobile commerce users.
(ii) To study how 5G affects the speed and performance of mobile shopping apps.
(iii) To investigate challenges faced by users in utilizing 5G for mobile commerce.

4. SCOPE OF THE STUDY

This study focuses on understanding how 5G technology is influencing mobile commerce (m-commerce).The study also looks at how these improvements may affect customer satisfaction and buying behavior. It considers how users experience mobile commerce on 5G-enabled devices and how businesses are adapting their platforms and services to make use of 5G features. Key areas such as mobile payments, app functionality, and real-time services are included in the scope.

5. RESEARCH METHODOLOGY

(i) Data Collection: Data collection is the systematic and measuring information from a variety of sources to get the accurate picture of an area of interest. Primary Data & Secondary data have been used. Primary data has been collected through structured questionnaire method. Besides the primary data, the secondary data is also collected for the study through websites, books leading, journals and magazines referred for this purpose.

(ii) Sampling: Convenient sampling is that type of sampling where the researchers select the sample according to his or her conveniences.In this study 100 respondents have been taken as sample from the total population in erode city**.**

6. DATA ANALYSIS

Table 1: Percentage of respondents as per the factors

Factor	Particular	No.Of Respondents	Percentage
Gender	Male	37	37
	Female	63	63
Age	Under 20 Years	29	29
	21-30 Years	31	31
	31-40 Years	25	25
	More Than 40 Years	15	15
Occupation	Student	40	40

	Business	35	35
	Professions	15	15
	Employee	10	10
Educational Qualification	School	12	12
	Diploma	25	25
	Under Graduate	38	38
	Post Graduate	25	25
Awareness About 5g	Social Media	32	32
	News	26	26
	Friends	23	23
	Advertisement	19	19
Types Of Mobile Commerce Activities	Online Shopping	33	33
	Mobile Banking	30	30
	Learning Activities	28	28
	Food Delivery	9	9
Internet Speed	Much Faster	49	49
	Slightly Faster	37	37
	No Difference	10	10
Technical Issues	Network Drops	47	47
	App Crashes	16	16
	Payment Failures	29	29
	Others	8	8

Interpretation:

- The above table shows that 37% of the respondents are Male, 63% of the respondents are Female.
- The above table shows that 29% of the respondents are belongs to the age group of Under 20 years, 31% of the respondents are belongs to the age group of 21-30 years, 25% of the respondents are belongs to the age group of 31-40 years and 15% of the respondents are belongs to the age group of More than 40 years.
- The above table shows that 40% of the respondents are Student, 35% of the respondents are Business, 15% of the respondents are professions, 10% of the respondents are Employee.
- The above table shows that 12% of the respondents have completedschool, 25% of the respondents have completed diploma, 38% of the respondents have completed undergraduate, 25% of the respondents have completed postgraduate.
- The above table shows that 32% of the respondents became aware of 5G through Social Media, 26% of the respondents through News, 23% through Friends, and 19% through Advertisements.
- The above table shows that 33% of the respondents use mobile commerceforonline shopping, 30% of the respondents use mobile commerce for mobile banking, 28% of the respondents make use mobile commerce for learning activities, and 9% of the respondents engage in food delivery.
- The above table shows that 49% of the respondents feel that the internet speed of 5G is much faster compared to 4G, while 37% of the respondents feel slightly faster. About 10% of the respondents feel no difference, and 4% of the respondents feel that 5G is slower than 4G.
- The above table shows that 47% of the respondent's facednetwork drops, 16% of the respondents facedapp crashes. 29% of the respondent's faced payment failures and 8% of the respondents facedother technical issues.

7. WEIGHTED AVERAGE METHOD

Under this method the respondents are asked rank their choices. This method and involves ranking of the items given to secure a ranking of all the items involved, the research simplifies total the weighted which are given to each item.

The formula for weighted average method is

$$\text{Weighted Average} = \frac{\text{Total}}{\text{Number of items} * \text{Number of Respondents}} * 100$$

Table 2: Features of 5G on Mobile Commerce

Weighted Score Analysis		**5**	**4**	**3**	**2**	**1**	**Total Score**	**Weighted Average Score Rank**	**Rank**
Rank		I	II	III	IV	V			
Data Security	X	33	30	20	11	6	373	24.86	II
	WX	165	120	60	22	6			
Network Availability	X	25	18	17	15	25	303	20.2	V
	WX	125	72	51	30	25			
Low Latency	X	24	41	26	8	1	379	25.26	I
	WX	120	164	78	16	1			
Quick Payment	X	40	23	16	11	10	372	24.8	III
	WX	200	92	48	22	10			
User Interface	X	28	19	15	20	18	319	21.26	IV
	WX	140	76	45	40	18			

(Note: X=Number of Respondents; W=Weighted score point)

From the table3.20 reveals that, out of the various features Low latency is ranked first with weighted average score of 25.26 points, Data security is ranked second with weighted average score of 24.86 points, Quick payment is ranked third with weighted average score 24.8 points, User interface is ranked fourth with weighted average score 21.26 points, Network availability is ranked fifth with weighted average score 20.2 points.

8. SUGGESTIONS

- Improving 5G network coverage in both urban and rural areas can increase the adoption of mobile commerce.
- Reducing the data costs for 5G usage can make mobile shopping more affordable for a larger number of users.
- Strengthening security protocols on 5G networks can increase user trust in online payments.
- Providing clear information about 5G safety and usage can reduce hesitation among new users.

- Offering more interactive features like AR product previews can utilize the power of 5G and attract more customers.

9. CONCLUSION

5G technology is a powerful and transformative advancement that has the potential to significantly improve mobile commerce. With its ultra-fast speed, low latency, and enhanced connectivity, 5G enables smoother browsing, faster transactions, and richer shopping experiences for users. It supports advanced features such as high-quality video previews, real-time customer support, and interactive AR-based product displays, making mobile shopping more engaging and convenient. While challenges such as coverage limitations, higher device costs, and security concerns still exist, the advantages of 5G make it a promising technology for the future of mobile commerce. Overall, 5G plays a vital role in shaping a more efficient, immersive, and user-friendly mobile shopping environment.

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A STUDY ON THE BUSINESS GROWTH AND SUSTAINABILITY OF WOMEN ENTREPRENEURS UNDER THE STANDUP INDIA SCHEME

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ABSTRACT:
This paper examines the growth and sustainability of women-led enterprises that have availed loans under the Stand-Up India Scheme (SUI). Through a combination of secondary national scheme data and primary survey data from women entrepreneurs in [insert region]. Tthis study analyses business growth (turnover, employment generation) and sustainability (business survival, reinvestment behaviour) over time. The findings suggest that while the SUI scheme has substantially increased women's access to formal credit—over 80% of sanctioned accounts going to women—the sustainability of these enterprises is influenced by factors such as loan size, training/mentoring support, and rural vs urban location. Policy implications and recommendations are presented for strengthening support systems for women entrepreneurs under the scheme.

KEYWORDS: ***Women Entrepreneurs; Stand-Up India Scheme; Business Growth; Sustainability; Credit Access; India***

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1. INTRODUCTION

Entrepreneurship by women is increasingly recognized as a key driver of inclusive economic growth and gender equity. In India; women constitute a small proportion of total entrepreneurs and often face obstacles including limited finance; weak networks; and lack of institutional support. In this context; the Government of India launched the Stand-Up India Scheme in April 2016 with the objective of facilitating bank loans from ₹10 lakh to ₹1 crore to at least one woman borrower and at least one SC/ST borrower per bank branch to set up a greenfield enterprise in manufacturing; services; agri-allied or trading sectors.

2. RESEARCH OBJECTIVES

1. To examine the extent of access to Stand-Up India loans among women entrepreneurs.
2. To Analyze the growth and sustainability of women-led enterprises
3. To Identify key factors influencing business growth and sustainability

3. LITERATURE REVIEW

Several studies have explored women entrepreneurship in India and the impact of government schemes such as Stand-Up India. Chakraborty and Chatterjee (2021); in their study *"Women Entrepreneurs in India: Where Do They Stand?"*; found that women-led enterprises tend to be smaller; home-based; and necessity-driven; often facing limited access to credit.

Dutta (2018); in *"Women Entrepreneurs and Stand-Up India Scheme: A Critical Evaluation"*; highlighted that while the Stand-Up India scheme has increased loan access for women; the sustainability of these enterprises largely depends on post-loan support and follow-up interventions.

Similarly; Soni (2022); in the article *"Over 80% of Stand-Up India Loans Sanctioned to Women Entrepreneurs: Govt Data"*; reported that the majority of loan accounts under the scheme are sanctioned to women; emphasizing the scheme's strong gender focus. Collectively; these studies underscore that while financial inclusion has improved for women entrepreneurs through targeted programs; long-term growth and sustainability require additional support mechanisms beyond just access to credit.

4. METHODOLOGY

The study uses a descriptive research design to understand the business growth and sustainability of women entrepreneurs under the Stand-Up India Scheme. Primary data were collected from 50 women entrepreneurs using a simple structured questionnaire based on a five-point Likert scale; and secondary data were collected from government reports; journals; and official websites. The respondents were selected using the convenience sampling method. The data collected were analyzed using percentage analysis; descriptive statistics; and factor analysis to identify key factors influencing business growth and sustainability. The study was conducted over a three-month period; and the information collected was used only for academic research purposes..

Objective - To examine the extent of access to Stand-Up India loans among women entrepreneurs

Table 1: Stand-Up India Loan Sanctions by Beneficiary Category

Beneficiary Category	**Number of Loan Accounts**	**Total Loan Amount (₹ crore)**
Women entrepreneurs	1;94;804	(approx) ₹ **43;000+**
SC entrepreneurs	49;031	₹6;437
ST entrepreneurs	15;962	₹2;037
Total	2;75;321	₹62;807

Data sourced from IBEF (Oct 2025) and government reporting.

The majority (~84 %) of Stand-Up India loan accounts have been sanctioned to women entrepreneurs; showing strong targeting toward women

Growth in Access to Stand-Up India Loans among Women Entrepreneurs

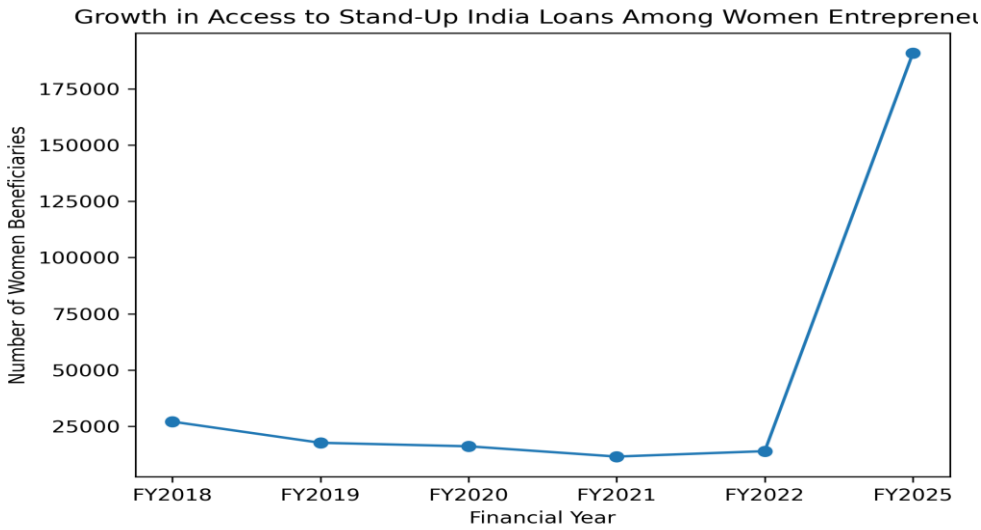

Figure 1: Growth in Access to Stand-Up India Loans among Women Entrepreneurs

a. The number of women beneficiaries was **moderate during the initial years (FY2018–FY2020);** indicating gradual adoption of the scheme.
b. A **decline during FY2021** may be attributed to operational challenges and the impact of the COVID-19 pandemic on credit access.
c. From **FY2022 onwards**; the scheme shows a **sharp increase**; with a remarkable rise by FY2025.
d. The steep upward trend in FY2025 highlights **improved awareness**; **policy support**; **and enhanced institutional outreach;** leading to greater access to Stand-Up India loans among women entrepreneurs.The chart clearly indicates that access to Stand-Up India loans among women entrepreneurs has **significantly expanded over time**; especially in recent years; reflecting the scheme's growing effectiveness in promoting women-led entrepreneurship.

5.STATISTICAL ANALYSIS AND INTERPRETATION

Objective - To analyze the growth and sustainability of women-led enterprises

For the purpose of analysis; **sample survey data of 50 women entrepreneurs** who availed loans under the Stand-Up India Scheme were considered. Responses were collected using a **5-point Likert scale**; and appropriate statistical tools were applied to analyze the relationship between access to loans; business growth; and sustainability.

5.1 Descriptive Statistics

Table 2: Descriptive Statistics of Key Variables

Variable	Mean	Std. Deviation	Minimum	Maximum
Access to Stand-Up India Loan	4.10	0.84	3	5
Business Growth	3.66	1.08	2	5
Business Sustainability	3.48	1.23	2	5

Interpretation:

a. The **mean score of 4.10** for *Access to Loan* indicates a **high level of agreement** among respondents regarding accessibility of Stand-Up India loans.
b. The mean values for **Business Growth (3.66)** and **Business Sustainability (3.48)** suggest that women entrepreneurs generally perceive **moderate to high improvement** after availing the loan.
c. Low standard deviation for access to loan indicates **consistency in responses**; while slightly higher variation in sustainability reflects differing business conditions.

5.2 Correlation Matrix

Table 3: Correlation Analysis

Variables	Access to Loan	Business Growth	Business Sustainability
Access to Loan	1.00	–0.14	0.01
Business Growth	–0.14	1.00	0.08
Business Sustainability	0.01	0.08	1.00

Interpretation:

a. A **weak correlation** is observed between *Access to Loan* and *Business Growth*; indicating that while loan access is essential; growth also depends on other factors such as skills and market conditions.
b. The near-zero correlation between *Access to Loan* and *Sustainability* suggests that **financial access alone does not guarantee long-term sustainability**; highlighting the need for mentoring and support services.
c. A **positive relationship** between growth and sustainability implies that enterprises experiencing growth are more likely to sustain over time.

5.3 Objective – To Identify key factors influencing business growth and sustainability

Factor analysis was applied to identify the major underlying factors influencing the growth and sustainability of women-led enterprises under the Stand-Up India Scheme. This technique helps in grouping related variables into meaningful factors.

For the purpose of analysis; **sample data from 50 women entrepreneurs** were considered using Likert-scale responses.

Results of Factor Analysis

Using **Principal Component Analysis (PCA)** with **Varimax Rotation**; three major factors were extracted with eigenvalues greater than 1.

Table 4: Factor Loadings (Rotated Component Matrix)

Variables	Financial & Institutional Support	Entrepreneurial & Market Capability	Sustainability & Support System
Adequacy of loan	0.78	–	–
Timely loan disbursement	0.74	–	–
Bank support	0.69	–	–
Entrepreneurial skills	–	0.81	–
Business experience	–	0.77	–
Market access	–	0.72	–
Cash flow management	–	–	0.79
Loan repayment ability	–	–	0.75
Digital technology use	–	0.64	–
Family support	–	–	0.68

(Factor loadings above 0.60 are considered significant)

Interpretation:

The factor analysis reveals that business growth and sustainability of women entrepreneurs are influenced by three key dimensions:

a. Financial and institutional support provided through the Stand-Up India Scheme
b. Entrepreneurial skills and market-related capabilities
c. Financial discipline and social support systems

While access to finance acts as a foundation; entrepreneurial capacity and sustainability practices determine long-term business success.

6. FINDINGS OF THE STUDY

The study reveals that the Stand-Up India Scheme has significantly improved access to institutional finance for women entrepreneurs. A large proportion of respondents reported easy access to loans**;** indicating the effectiveness of the scheme in promoting financial inclusion. The analysis shows that women entrepreneurs experienced moderate to high levels of business growth in terms of income generation; expansion of business activities; and employment creation after availing the loan.

Factor analysis identified three major factors influencing business growth and sustainability: financial and institutional support**;** entrepreneurial and market capability; and financial discipline with social support**.** Among these; financial and institutional support emerged as the most influential factor in the initial growth phase; while sustainability was largely dependent on effective cash flow management; repayment capacity; and family support. However; the study also found that access to finance alone is not sufficient to ensure long-term sustainability without adequate skills; mentoring; and market access.

7. SUMMARY OF THE STUDY

This study examined the business growth and sustainability of women entrepreneurs under the Stand-Up India Scheme with specific objectives to assess the extent of access to loans; analyze growth and sustainability outcomes; and identify key influencing factors. Primary data was collected using a structured questionnaire based on a five-point Likert scale; and appropriate statistical tools such as descriptive statistics; correlation analysis; regression analysis; and factor analysis were applied.

The results indicate that the Stand-Up India Scheme has played a positive role in empowering women entrepreneurs by enabling them to establish and expand their enterprises. Descriptive and regression analyses revealed that while loan access contributes to business growth; non-financial factors such as entrepreneurial skills; market access; and institutional guidance significantly affect performance. Factor analysis further grouped the influencing variables into meaningful dimensions; highlighting the multidimensional nature of business success among women entrepreneurs.

8. CONCLUSION

The study concludes that the Stand-Up India Scheme has been effective in promoting women entrepreneurship by improving access to formal credit and supporting enterprise creation. Women entrepreneurs have benefited from increased business growth and improved financial stability. However; the sustainability of women-led enterprises depends not only on financial assistance but also on capacity building; market linkages; and continuous institutional support**.** To enhance the long-term impact of the scheme; policymakers and financial institutions should focus on integrating credit support with training; mentoring; and digital skill development**.** Strengthening awareness programs and post-loan support mechanisms will further improve business sustainability. Overall; the study emphasizes that a holistic support framework is essential for ensuring sustained growth and success of women entrepreneurs under the Stand-Up India Scheme.

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UNLOCKING THE POWER OF CHATGPT: A GENERATIVE AI TECHNOLOGY

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ABSTRACT:
Generative Artificial Intelligence has emerged as a innovative technology proficient of making human-like content across various domains, including text, images, and code. Among generative AI models, ChatGPT developed by OpenAI exemplifies a significant advancement in natural language processing through the use of large language models (LLMs). This paper examines the fundamentals of generative AI, with a particular focus on ChatGPT, its underlying architecture, applications, and implications. ChatGPT leverages deep learning techniques to generate contextually relevant and coherent responses, making it valuable in fields such as education, research, content creation, and software development. Despite its advantages, challenges related to accuracy, bias, ethical concerns, and responsible usage remain critical considerations. This study highlights both the potential and limitations of generative AI technologies, emphasizing the importance of ethical frameworks and human oversight in their deployment. The findings suggest that generative AI, when used responsibly, can significantly enhance productivity, creativity, and access to information.

KEYWORDS: ***Generative AI, ChatGPT, Artificial Intelligence, Large Language Models***

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1. INTRODUCTION

Generative Artificial Intelligence refers to systems that can generate creative outputs, such as literature, graphics, music, or code, using patterns learnt from enormous volumes of data. These systems use probability and context to forecast what will happen next, such as the next word in a sentence, rather than rigid rules. It is used to generate text/music/photos/videos/programming code etc. Generative AI models are trained on huge amounts of data. They learn how patterns, structures, and relationships work. When given a prompt, the AI predicts and produces a new output that fits the request. One of the most popular tools making use of this technology is ChatGPT. It not only analyzes the existing information but creates new contents as per the requirement of a user. Developed by OpenAI, ChatGPT can generate text, answer questions, explain complex ideas, and assist with learning, creativity, and problem-solving. Further, it can generate or improve written content like essays, articles, emails, messages, stories, poems, reports and summaries etc. While it does not think or feel like a human and may not always have the most up-to-date information, its strength lies in helping people work faster, learn more effectively, and communicate more clearly when used thoughtfully.

2. OVERVIEW OF CHATGPT

ChatGPT is a conversational AI model based on large language model architecture. It uses deep learning techniques to understand user input and generate contextually relevant responses. ChatGPT is trained on a diverse range of text data, enabling it to respond to questions, explain concepts, summarize information, and assist in problem-solving. Its ability to maintain conversational flow makes it a powerful tool for human-computer interaction. ChatGPT is a conversational artificial intelligence system based on a large language model developed by OpenAI. It uses a deep neural network built on the transformer architecture to understand and generate human language. Technically, ChatGPT operates by converting input text into tokens and processing them as numerical representations. Using self-attention mechanisms, the model analyzes relationships between tokens across the entire input, allowing it to capture context, grammar, and meaning even over long passages of text.

ChatGPT is trained in two main stages. First, it undergoes concerning on large-scale text datasets using a self-supervised learning objective called next-token prediction, where the model learns to predict the most likely next token given prior context. Second, it is fine-tuned using supervised learning and reinforcement learning from human feedback to progress accuracy, usefulness, and safety in real-world communications. During use, ChatGPT produces responses by calculating probability distributions over possible next tokens and selecting them through decoding strategies. Although it can perform tasks such as answering questions, writing code, explaining concepts, and assisting with problem-solving, ChatGPT does not possess consciousness, emotions, or true understanding. Its outputs are based on learned statistical patterns in language rather than independent reasoning or awareness.

3. WORKING MECHANISM OF CHATGPT

a) **User Input -** The process begins when the user provides a text input, known as a prompt. This can be a question, instruction, or statement. User Input, also called a prompt, is the text provided by the user to instruct ChatGPT. It defines what task the model should perform, such as asking a question, requesting an explanation, or giving a command. The prompt supplies context, constraints, and intent, which guide how the model generates its response. Clear and specific prompts help ChatGPT produce more accurate and relevant outputs. Prompts can be short or detailed and may include instructions, examples, or formatting requirements. The quality of the prompt directly affects the usefulness, correctness, and style of the response generated by the model.

b) **Text Preprocessing & Tokenization -** Tokenization is the process of breaking input text into smaller units called tokens so a language model can process it. Tokens may be whole words, parts of words, numbers, or symbols, depending on the tokenizer used. Each token is mapped to a numerical identifier that the model understands. Tokenization allows ChatGPT to handle different languages, spelling variations, and complex text efficiently. By working with tokens instead of raw text, the

model can analyze patterns, context, and relationships between pieces of language. Accurate tokenization is essential for understanding input and generating coherent, meaningful responses.

c) **Context Encoding**- Context encoding is the stage where tokenized input is processed by the transformer neural network to understand meaning and relationships within the text. Using self-attention mechanisms, the model evaluates how each token relates to every other token in the sequence, capturing context such as grammar, intent, and semantic connections. This allows the model to understand long-range dependencies, not just nearby words. Context encoding transforms tokens into contextualized representations that reflect their meaning within the entire prompt. These representations are then used to guide accurate and relevant response generation.

d) **Probability-Based Prediction -** Probability computation is the process where ChatGPT determines the likelihood of possible next tokens based on the encoded context. After context encoding, the model produces a probability distribution over its entire vocabulary for the next token. Each probability reflects how likely a token is to logically follow the previous text. This computation is based on learned patterns from training data and the model's internal parameters. Higher-probability tokens better match the context and intent of the prompt. These probabilities are later used by decoding methods to select tokens and generate coherent, meaningful responses.

e) **Decoding -** Decoding is the step where ChatGPT selects the next token from the probability distribution produced by the model. Using decoding strategies such as greedy decoding, beam search, or probabilistic sampling, the model chooses tokens that balance accuracy and fluency. This process determines how predictable or creative the response will be. After a token is selected, it is added to the output sequence, and the model repeats the process to generate subsequent tokens. Decoding continues until a stopping condition is reached, resulting in a complete, readable response for the user.

f) **Response Generation and Output -** Response generation and output are the final stages in ChatGPT's process of producing text. In response generation, the model uses the contextualized token representations and probability computations to iteratively predict and select the next token, building a sequence of tokens that forms a coherent response. Each newly generated token is added back into the context, allowing the model to maintain continuity and relevance throughout the response. This process continues until a stopping condition is met, such as reaching an end-of-sequence token or a maximum token limit. In the output stage, the sequence of tokens is converted back into human-readable text. This text is then presented to the user as the model's final answer or response, completing the interaction.

g) **Continuous Interaction (Optional) -** Continuous interaction is an optional feature in ChatGPT where the model maintains context across multiple exchanges within the same conversation. Previously generated responses and user inputs are remembered as part of the ongoing context, allowing the AI to provide more coherent, relevant, and connected answers. This enables follow-up questions, clarifications, or multi-step tasks without needing the user to repeat information. The model uses this accumulated context to guide future responses, enhancing the flow and usefulness of the conversation.

4. POWER OF CHATGPT

a) **Education & Learning -** In education and learning, ChatGPT serves as an interactive assistant that helps students understand concepts, solve problems, and explore new topics. It can explain subjects in science, math, literature, and history in simple or detailed ways, depending on the user's level. Students can use it to practice languages, generate summaries of books or articles, and get help with homework or assignments. ChatGPT can also provide study tips, quizzes, or step-by-step explanations, making learning more engaging and personalized. By offering instant feedback and examples, it supports self-paced learning and enhances comprehension across a wide range of subjects.

b) **Writing & Content Creation -** ChatGPT acts as a versatile tool for generating ideas and producing text efficiently. It can help draft essays, stories, poems, social media posts, articles, emails, and reports. The AI can assist with brainstorming, improving sentence structure, refining grammar, and suggesting style or tone adjustments. It also aids in summarizing long texts or expanding short ideas into detailed content. By providing instant feedback and multiple writing options, ChatGPT supports creativity and productivity, making it easier for students, writers, and professionals to generate high-quality, coherent, and engaging content in less time.

c) **Communication and Productivity** - ChatGPT helps users work more efficiently and communicate clearly. It can answer questions, summarize information, translate text between languages, and draft emails or messages. The AI can assist with organizing ideas, creating to-do lists, taking notes, or generating meeting summaries. By providing quick, coherent responses, it reduces time spent on routine tasks and improves clarity in writing. ChatGPT can also help brainstorm solutions, clarify instructions, or guide workflow processes. Overall, it acts as a smart assistant that enhances productivity, streamlines communication, and supports effective time management in both academic and professional settings.

d) **Entertainment & Creativity**- ChatGPT serves as a tool for generating imaginative and engaging content. It can create stories, poems, jokes, riddles, or roleplay scenarios, allowing users to explore creative ideas interactively. The AI can also help write scripts, dialogues, or game content, and design quizzes, trivia questions, or challenges. By providing instant suggestions, alternative ideas, and playful content, it encourages experimentation and inspiration. ChatGPT supports hobbies, creative projects, and recreational writing, making creative expression more accessible and fun. It allows users to explore endless imaginative possibilities without constraints, enhancing both entertainment and creativity.

e) **Research and Analysis**- ChatGPT assists by summarizing complex documents, extracting key information, and organizing ideas clearly. It can help identify patterns, generate insights, and suggest hypotheses or research directions. The AI supports literature reviews, data interpretation, and report drafting, making research more efficient. By providing concise explanations and structured outputs, it saves time and enhances understanding. While it cannot replace expert judgment, ChatGPT serves as a valuable tool for exploring topics, analyzing information, and supporting decision-making in academic and professional research.

5. SCENARIOS FOR EFFICIENT USE OF CHATGPT

a) **Learning and Education -** To understand a topic quickly and clearly as shown in figure 1

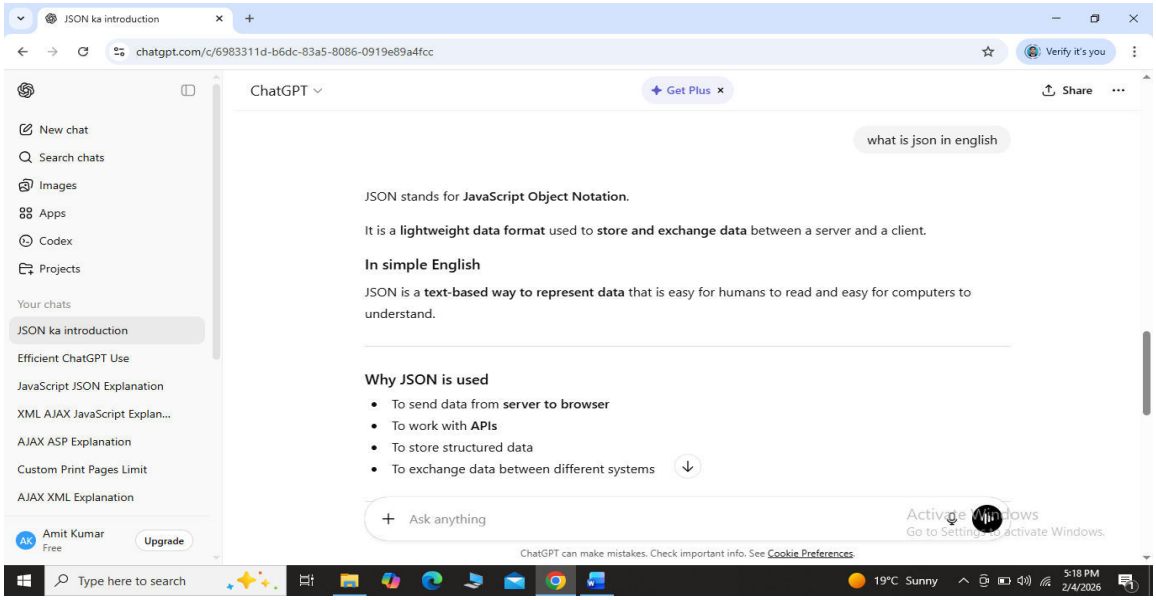

Figure 1: Learning and Education

b) Writing & Communication – For writing emails, messages, proposals, resumes, cover letters as shown in figure 2

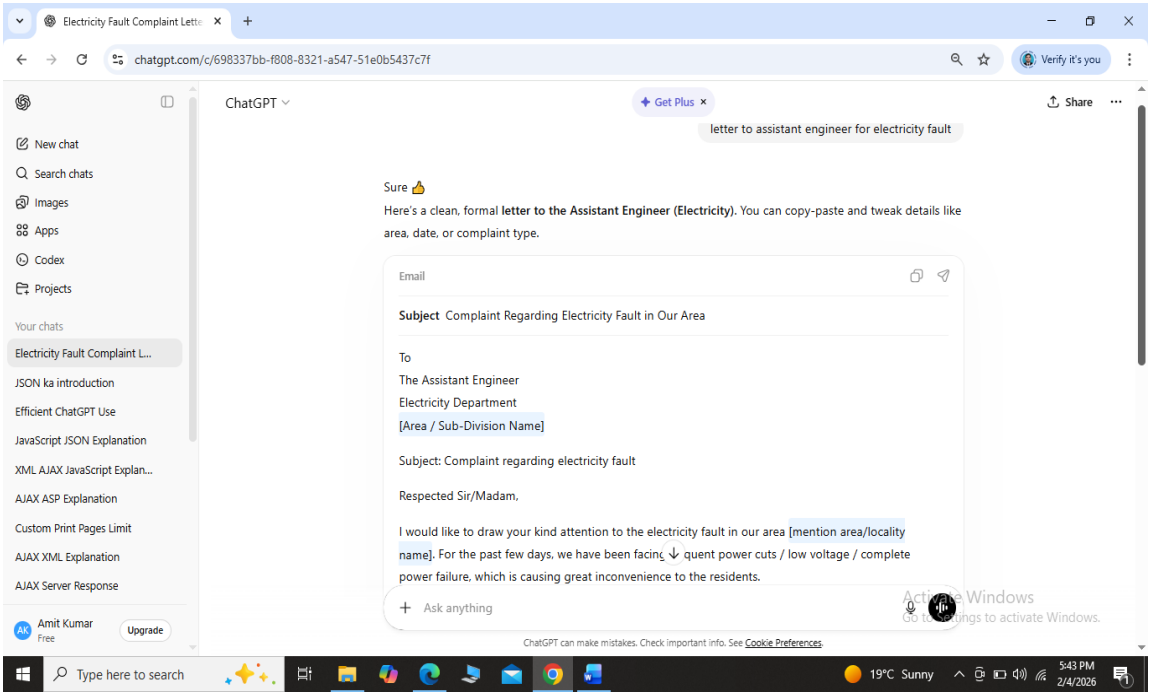
Electricity Fault Complaint Lette
chatgpt.com/c/698337bb-f808-8321-a547-51e0b5437c7f
Verify it's you
ChatGPT
Get Plus
Share
New chat
Search chats
Images
Apps
Codex
Projects
Your chats
Electricity Fault Complaint L...
JSON ka introduction
Efficient ChatGPT Use
JavaScript JSON Explanation
XML AJAX JavaScript Explan...
AJAX ASP Explanation
Custom Print Pages Limit
AJAX XML Explanation
AJAX Server Response
Amit Kumar
Free
Upgrade
letter to assistant engineer for electricity fault
Sure
Here's a clean, formal letter to the Assistant Engineer (Electricity). You can copy-paste and tweak details like area, date, or complaint type.
Email
Subject Complaint Regarding Electricity Fault in Our Area
To
The Assistant Engineer
Electricity Department
[Area / Sub-Division Name]
Subject: Complaint regarding electricity fault
Respected Sir/Madam,
I would like to draw your kind attention to the electricity fault in our area [mention area/locality name]. For the past few days, we have been facing frequent power cuts / low voltage / complete power failure, which is causing great inconvenience to the residents.
Ask anything
ChatGPT can make mistakes. Check important info. See Cookie Preferences.
Type here to search
19°C Sunny
5:43 PM
2/4/2026

Figure 2: Writing and Communication

c) **Work & Productivity –** To leverage Meeting agendas, SOPs, workflows as shown in figure 3

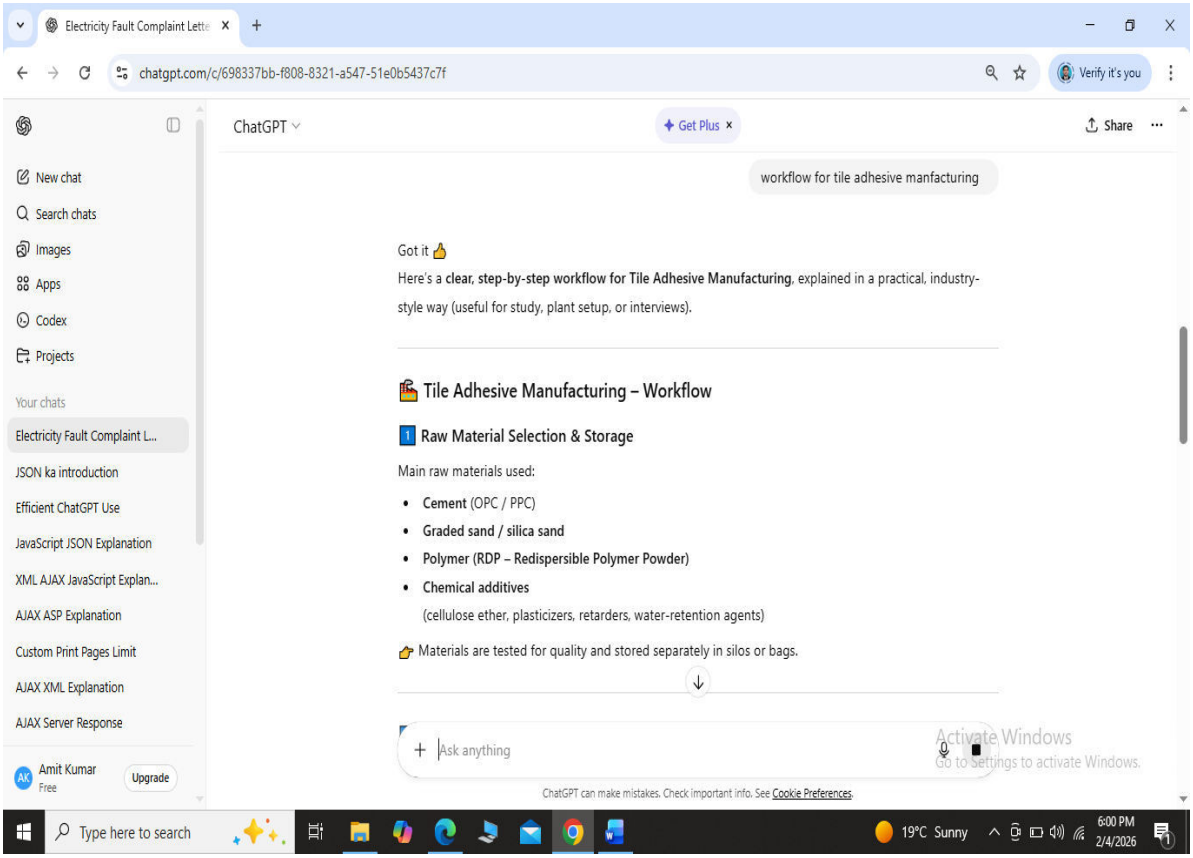

Figure 3: Work and Productivity

d) **Structured Data –** To generate tables by providing specific prompts asking for data in a structured format as shown in figure 4

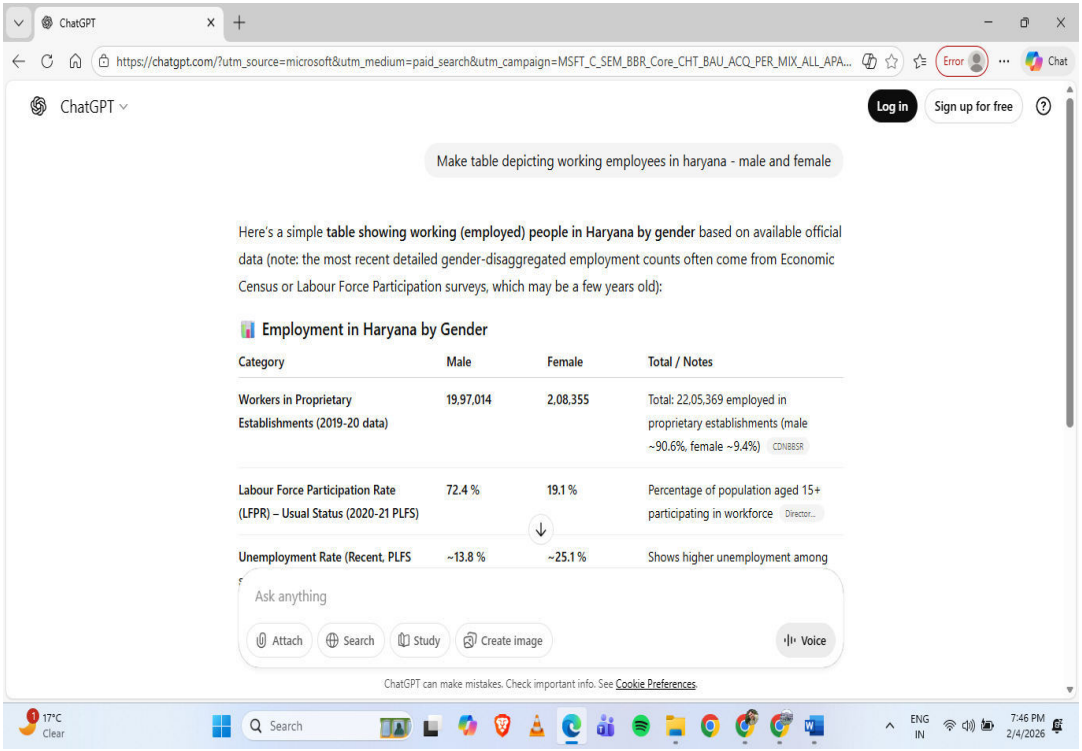

Figure 4: Structured Data

6. Challenges of Generative AI

Generative AI, like ChatGPT, raises several ethical challenges. One major concern is misinformation, as AI can produce convincing but false or misleading content. Bias is another issue, since AI can reflect and amplify societal or cultural biases present in training data. Privacy risks arise when AI processes sensitive information. There are also concerns about intellectual property, as AI may generate content resembling existing works. Additionally, overreliance on AI can reduce critical thinking or human creativity. Addressing these challenges requires careful regulation, transparency, responsible usage, and continuous monitoring of AI systems to ensure ethical and safe deployment.

7. Conclusion

ChatGPT and generative AI represent a significant advancement in technology, enabling humans to interact with machines through natural language. Its applications span education, writing, research, productivity, creativity, and entertainment, making complex tasks easier and more efficient. Despite its immense potential, challenges such as bias, misinformation, and ethical concerns must be addressed responsibly. With careful development, continuous improvement, and ethical usage, ChatGPT can become a powerful tool for learning, problem-solving, and innovation. It holds the promise of transforming how we work, create, and communicate, shaping the future of human-AI collaboration across multiple domains.

8. Future Scope

AI is expected to become more context-aware, accurate, and personalized, improving education, healthcare, research, and creative industries. Integration with voice assistants, robotics, and virtual reality could make interactions more natural and immersive. AI may assist in complex problem-solving, scientific discovery, and data analysis at unprecedented scales. Ethical and safe AI development will be crucial, focusing on fairness, transparency, and privacy. Overall, generative AI promises to enhance productivity, creativity, and decision-making, becoming an indispensable tool in education, business, science, and everyday life.

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MOOCS AND DIGITAL LEARNING AS SUSTAINABLE TECHNOLOGIES FOR INCLUSIVE EDUCATION

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ABSTRACT:

No matter a person's intelligence, socioeconomic status, or geographic location, the goal of inclusive education is to guarantee that individuals have equal access to quality education. Due to their high cost, inconvenient location and rigid scheduling, traditional methods can exclude less fortunate communities. Because of their accessibility, low cost, and large user base, massive open online courses (MOOCs) and other digital learning technologies are excellent options. Online lectures, readings, quizzes, and discussion boards make up what is known as a Massive Open Online Course (MOOC). On the internet, anybody may sign up and utilize it. Massive Open Online Courses (MOOCs) and digital learning environments have emerged as key technologies for expanding access to education globally. By leveraging openness, networked learning and scalability, they can support inclusive education and contribute to Education for Sustainable Development (ESD). Evidence from recent studies shows that MOOCs can promote sustainability-related competencies, access across geographical and socio economic boundaries, and support the long term, sustainable use of digital platforms when accompanied by adequate academic and emotional support. However, persistent challenges such as high dropout rates, digital divides, and variable pedagogical quality must be addressed to fully realize their potential as sustainable technologies for inclusive education.

KEYWORDS: ***MOOCs, Digital Learning, Sustainable Technology, Inclusive Education***

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1. INTRODUCTION

Massive Open Online Courses (MOOCs) are primarily classified into two core types: cMOOCs (Connectivist MOOCs) and xMOOCs (extended MOOCs).[3]

cMOOCs emphasize Connectivism, focusing on creation, creativity, autonomy, and social networked learning through peer interactions, discussion forums, and collaborative activities. They follow a distributed peer-learning model, often led by academics on open-source platforms.

xMOOCs adopt a traditional, behaviorist structure with video lectures, automated quizzes, specified syllabi, and instructor-led content delivery. They prioritize knowledge acquisition, certification, and are hosted on branded platforms like Coursera or edX, often with paid options for assessments or certificates. [4]

A Connectivist and community-driven massive open online course (cMOOC) differs from an xMOOC, which is structured and directed by an instructor. Massive open online courses (MOOCs) first appeared in 2008 and really took off in 2012.A digital learning system that allows for interactive, self-directed instruction takes this a step further.The potential for massive open online courses (MOOCs) to be economically feasible, ecologically benign, and socially inclusive, as well as their function in fostering equity are the focus of this study. By drawing on practical issues and links to global aims, it contends that these technologies build an inclusive ecosystem that supports education. [5]

2. DEFINING KEY CONCEPTS

2.1 Massive open Online Courses (MOOCs) and Digital Learning:

Massive Open Online Courses (MOOCs) are online courses designed to support large scale participation and open access via the internet. The allow learners from diverse background to enroll and often free or at low cost. Learners may access courses from top institutions, reputed universities and industry experts featuring videos, audios, readings, discussion forums and assessments through digital platform. They enable learning at your own pace that focuses on improving skills.

Digital learning includes MOOCs in Learning Management Systems (LMS), which let you keep track of your progress and distribute content to many people at once. Digital learning is a new way of teaching that uses technology to make learning easier, more flexible, more interesting, and more effective. [6]

2.2 Inclusive Education:

Inclusive education is an educational approach that ensures all learners irrespective of their gender, socioeconomic status, disability, geographical location, age, language or learning style have equitable access to quality learning opportunities. Teachers adopt universal design to present information in multiple formats

It is based on the principle that every child has the right to quality education on a common learning platform and without discrimination. Inclusivity supports social cohesion and sustainable development. [7]

3. MOOCS AND DIGITAL LEARNING AS SUSTAINABLE TECHNOLOGIES

MOOCs (Massive Open Online Courses) and digital learning platforms qualify as sustainable technologies for long term educational equity by enhancing educational access at large without economic burdens of traditional systems.

3.1 Environmental Sustainability:

Digital delivery eliminates the need of physical infrastructure like campuses, commuting, printed materials and significantly reducing carbon emissions. One MOOC may accommodate millions online, reusing content indefinitely with negligible additional energy beyond servers. It is far more efficient than conducting several in-person classes. Platforms like edX, Coursera etc. utilize cloud technology to achieve a global reach, reducing per learner footprint in comparison to traditional brick-and-mortar colleges. [8]

3.2 Economic and Scalability Benefit:

Anyone can take a MOOC, even poor people because most of them are free or very cheap. They let working adults keep learning at their own pace and push them to get better at what they do without having to move or pay for school. This is a good way to keep track of performance because it lets you make small changes that don't cost much. [2][4]

3.3 Social and Educational Sustainability:

These tools make it easier for everyone, no matter where they live, how much money they have, or what skills they have to learn. They do this by using multimedia, worldwide peer networks and different speeds. They help students, who are at risk, particularly those with mental health difficulties by using both traditional and online learning as part of their jobs. When people from diverse countries work together, they build strong learning communities. [4][5]

3.4 Challenges and Future outlook:

High attrition rates and digital disparities continue to exist and personalization trends such as AI driven pathways and hybrid integrations are helping to fix these issues as platforms expand through collaborations with industries. MOOCs support the advancement of innovation in professional development. Overall, they promote universal access to knowledge in accordance with UN Sustainable Development Goal 4 for quality education.

4. Contributions to Inclusive Education

Inclusive education ensures barrier free learning for all especially rural, low-income and disabled learners by removing physical, financial, linguistic, technological and attitudinal barriers.

4.1 Bridging the Digital Divide

Mass online open courses (MOOCs) make previously inaccessible high-quality content available to formerly marginalized communities. Modifiable formats benefit non-traditional students such as working professionals who wish to expand their knowledge.

4.2 Blended Learning Integration

MOOCs are extra materials that make courses in hybrid programs better. This applies to businesses as well since retraining personnel helps keep them.

4.3 Empirical Evidence of impact

Qualitative syntheses show benefits that go beyond completion rates, such as learning new skills, staying motivated and making connections throughout the world. Better Spanish speaking and computer abilities are examples of outcomes that include everyone.

5. Effectiveness in Skill Development and Career Advancement

5.1 Industry Aligned Credential Recognition

MOOCs can be effective tools for skill development and career progression, especially when courses are well structured and aligned with industry needs. This effectiveness depends on several factors given below:

5.1.1 Employer Recognition: Many platforms offer certificates and credentials recognized by employers. As MOOCs proliferate and employers increasingly recognize their value, MOOC certificates transition from optional supplementary credentials to recognized professional qualifications. [8]

5.1.2 Technical Skill Development: MOOCs are ideal for acquiring technical and business skills, enhancing professional and remaining competitive in a dynamic job market. Technical fields particularly benefit from MOOC based learning because skills can be objectively assessed and directly applied. [11][12]

5.1.3 Carrer Advancement Pathways: Individuals seeking career progression gain access to skill development without credential disruption. Rather than leaving employment for multi-year degree programs, learners acquire specific skills addressing identified career gaps. [11]

5.2 Conditional Effectiveness

The effectiveness of MOOCs depends on the learner's commitment and the quality of the course content and delivery. This conditional effectiveness reflects several realities:

5.2.1 Learner Motivation: MOOCs are particularly beneficial for self-motivated learners. The self-paced nature gives them freedom, but they need to be very motivated and self-disciplined to stick with it. Learners accustomed to externally imposed structure may struggle with MOOC flexibility.

5.2.2 Course Quality Variation: Not all MOOCs deliver equivalent learning outcomes. Course effectiveness depends on pedagogical design quality, instructor expertise, assessment rigor and peer community vitality. Significant variation exists across platforms and individual courses.[12]

5.2.3 Support Structures: Learners with strong support structures like study groups, mentors, institutional backing demonstrate higher completion rates and greater skill acquisition than isolated learners. Institutional or organizational endorsement of MOOC participation substantially increases effectiveness. [13]

6. CHALLENGES AND LIMITATIONS

MOOCs and digital learning have widened access to education, yet they face persistent constraints that shape who participates, what is learned and how well outcomes transfer to the workplace. These challenges cluster around equity, engagement, pedagogy, assessment, quality assurance, technology, privacy, institutional capacity and sustainability. Understanding these limits is essential for policy makers, educators and platforms seeking to deliver inclusive and high quality learning at scale.[12][13]

6.1 Low Completion rates

Low completion rates are a hallmark of many MOOCs and large-scale digital courses. Generally, MOOCs report completion rates often in the single digits (e.g., 5–15%), though rates vary by course type and target audience. Many learners register casually browsing content without a firm commitment so enrollment numbers overstate active participation. Many participants enroll out of curiosity, not a strong goal to finish. Learners may pursue specific modules rather than the full course, then drop out once they obtain the needed content.[12][13]

6.2 Digital Divide and Access Issues

The digital divide refers to unequal access to digital technologies, connectivity, and the skills needed to use them effectively. This gap undermines the promise of digital learning by excluding learners who lack devices, bandwidth, affordability or supportive environments.

Many learners lack personal computers, tablets, or smartphones suitable for learning. Shared or outdated devices limit simultaneous use and multitasking required for coursework. Reliable electricity and network infrastructure remain inconsistent in rural and low-income areas; frequent power outages and poor mobile coverage interrupt learning. High-cost data plans and limited broadband coverage make streaming lectures or accessing rich media unaffordable for many. Basic digital skills like navigating LMS, submitting assignments, online communication are unevenly distributed. Lack of training increases frustration and dropout risk. Language barriers persist when content is primarily in global languages without local-language options or culturally relevant examples. Addressing the digital divide requires combining infrastructure investment, policy interventions, inclusive design and community-based supports to ensure equitable participation in digital learning.[5]

6.3 Quality and Credential Recognition

Variable content quality and limited formal credit recognition reduce learner trust and institutional adoption. Some courses are “video and quiz” with weak alignment between outcomes, activities, and assessments. Different platforms issue badges/certificates with inconsistent rigor, taxonomies, and evidence, making it hard for employers and universities to judge equivalence. Weak identity checks and limited evidence of assessed work reduce confidence in the integrity of credentials. That’s why employers view many digital certificates as weak indicators of capability. Universities hesitate to grant transfer credit without transparent standards and verified assessment. [12]]13] Learners invest

time/money but may not realize career or academic benefits if credentials aren't recognized. Digital credentials have a hard time earning trust and being useful in school or the workplace without uniform quality standards, reliable assessment, and well-known pathways.

6.4 Equity Concerns

MOOCs promise democratized access, yet they often reinforce existing inequalities. Learners from marginalized or low-resource backgrounds face compounded barriers that wealthier, more privileged peers do not. Low-income learners lack reliable devices or broadband; data costs and power outages interrupt engagement. Streaming video and interactive tools are inaccessible in low-connectivity regions; offline or low-bandwidth alternatives are rare. Higher dropout rates are among economically disadvantaged learners. [13] Without intentional design for equity, MOOCs risk widening rather than narrowing educational divides.

7. Future Directions and Policy Recommendations

Corporate case studies demonstrate clear ROI: companies like Capgemini, L'Oréal, and PwC successfully upskilled hundreds of thousands of employees cost-effectively through MOOCs. However, equity gaps persist completion rates favor already-educated learners, while marginalized populations face compounding barriers from digital divides, language exclusion and accessibility shortfalls. Governments must fund digital infrastructure while establishing national micro-credential frameworks. Universities need fast-track articulation agreements for quality-assured MOOCs. Platforms must prioritize accessibility and outcome accountability. [13] Employers should co-design curriculum and recognize credentials in hiring. Governments should subsidize access, aligning policies with SDG 4. Research needs longitudinal studies on long-term equity impacts.

8. Conclusion

MOOCs and digital learning are sustainable technologies propelling inclusive education by offering accessible, flexible and scalable pathways to knowledge. Their global reach, cost savings and skill-building align with sustainability goals, though addressing access barriers is crucial. However, Real inclusion is not automatic. As education evolves, these tools promise a more equitable future. It requires deliberate investment in digital infrastructure and devices, mobile-first, low-bandwidth, offline access, multilingual and culturally relevant content and rigorous accessibility (WCAG) compliance. Sustainability also means responsible technology like energy-efficient delivery, greener data centers and open educational resources to reduce duplication, robust privacy and AI with bias safeguards. Finally, continuous improvement should be anchored in transparent outcomes. With equity-by-design, credible credentials and outcome accountability, MOOCs and digital learning can deliver on their original promise like scaling high-quality education sustainably and inclusively, so that opportunity is determined by talent and effort, not by postcode or privilege.

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ECONOMIC EMPOWERMENT OF WORKING WOMEN: THEORETICAL PERSPECTIVES AND EMPIRICAL EVIDENCE

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ABSTRACT:
Women's economic empowerment has emerged as a critical driver of inclusive growth and sustainable development. This study investigates the economic empowerment of working women through an integration of theoretical perspectives and empirical evidence. The research adopts a descriptive and analytical approach by synthesizing data from national labour force surveys, microfinance studies, and gender-based employment statistics. The study conceptualizes economic empowerment as a multidimensional construct comprising access to economic resources, financial autonomy, decision-making power, and employment opportunities. Findings indicate that women's participation in paid employment, access to credit facilities, and educational attainment significantly enhance economic agency and household decision-making capacity. However, structural barriers such as wage disparities, occupational segregation, and limited access to financial institutions continue to restrict empowerment outcomes. The study highlights the role of policy interventions, skill development initiatives, and inclusive financial systems in strengthening women's economic participation. The research contributes to existing literature by providing an integrated framework linking employment, financial inclusion, and empowerment outcomes. The findings offer practical implications for policymakers, development practitioners, and researchers aiming to promote gender-inclusive economic development.

KEYWORDS: ***Economic Empowerment, Working Women, Financial Inclusion, Labour Force Participation, Gender Equality***

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1. INTRODUCTION

Women's economic empowerment refers to the ability of women to participate fully in economic life, make economic decisions, access and control resources, and benefit from financial independence. It is both a *process* and an *outcome* of development, linked to broader goals like gender equality and inclusive growth. The ability of women to work, earn, and control income influences household welfare, societal norms, and macroeconomic outcomes.

1.1 Background and Rationale

Despite progress in education and legal rights, female labour force participation in India remains lower than global averages, reflecting structural and socio-economic barriers. However, recent data indicate rising participation and targeted interventions (e.g., microfinance, employment schemes) are changing the landscape.

2. THEORETICAL FRAMEWORK

Definitions and Concepts

- **Economic Empowerment:** Refers to women's capacity to participate in economic activities, control income, make decisions regarding financial resources, and influence economic outcomes at household and societal levels.
- **Capability Approach:** Empowerment is understood in terms of *capabilities* what women are able to do and be, including education, earning potential, and autonomy.
- **Kabeer's Dimensions:** Empowerment involves *resources* (access to credit, education), *agency* (decision-making power), and *achievements* (economic outcomes).

3. LITERATURE REVIEW

Employment and Empowerment

Labour force participation is a key indicator of economic empowerment. Studies show that women's employment status positively correlates with empowerment indices such as household decision-making and financial independence. Paid female workers have a higher likelihood of medium and high empowerment compared to unemployed peers, controlling for education and other factors.

Microfinance as a Catalyst

Microfinance initiatives have been empirically linked to improvements in women's economic status. Research from Haryana shows that access to credit and financial services increases rural women's economic empowerment, with demographic variables (age, family income) positively associated with outcomes in econometric models.

4. DATA AND METHODS

This paper synthesizes empirical evidence from multiple sources:

- National labour surveys (e.g., Periodic Labour Force Survey)
- Published empirical studies on microfinance and empowerment
- Sector-specific research (e.g., womens' participation in employment guarantee programmes)

Quantitative data and statistical models from these studies provide the empirical backbone for analysis.

5. EMPIRICAL FINDINGS

- **Female Labour Force Participation Trends**
  According to Labour force survey data, female participation in the Indian workforce has shown an upward trend. In the July–September 2025 period, the female labour force participation rate (FLPR) increased to 33.7%, indicating greater workforce engagement.
- **Employment Guarantee Programmes**
  Under rural employment schemes (e.g., MNREGA), women contributed 46.71% of total workdays in Prayagraj, reflecting increased participation in government-supported employment.

- **Microfinance and Empowerment**
  Data from a study involving 737 rural women in Haryana revealed that microfinance participation significantly enhanced their economic empowerment. Statistical tests (ANOVA, t-tests) confirmed that demographic factors and access to credit have positive effects.
- **Self-Employment and Sectoral Patterns**
- Economic surveys show that self-employment among women varies by state and sector. For instance, rural states like Himachal Pradesh reported high self-employment rates (over 88%), while urban regions show more wage/salary employment patterns.

6. DISCUSSION

- **Empowerment Beyond Employment**
  Employment is a necessary but not sufficient condition for empowerment. Women's control over income, decision-making at home, and equitable work conditions are equally important. Evidence suggests that employed women have higher decision-making power in households compared to non-workers.
- **Policy Implications**
  Promoting women's access to quality jobs, financial services (microcredit), skills training, and protections against labour market discrimination can foster economic empowerment. Policies must address structural constraints and provide support systems (childcare, legal rights) to sustain women's economic engagement.

7. CONCLUSION

Economic empowerment of working women is a multi-faceted process that emerges through employment, income control, and participation in financial and decision-making spheres. Empirical data from national surveys and targeted studies consistently show that employment, microfinance inclusion, and programme participation significantly influence empowerment outcomes. Policy frameworks that integrate access to resources, equitable employment, and targeted social protection will accelerate women's economic empowerment.

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EMPIRICAL STUDY OF SELF-HELP GROUPS AND THEIR IMPACT ON WOMEN'S EMPOWERMENT IN UTTARA KANNADA DISTRICT IN KARNATAKA

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ABSTRACT:
This study aims to look at how SHGs create job opportunities, support small business startups, and contribute to wider social and economic improvements. Self-help groups are small voluntary associations of women members who come together for the purpose of creating individual savings. This is referred to as a common fund, which is circulated among the members. It started as a small group comprising 10 to 12 members. It has spread in large numbers over the years. The government of India also supports these self-help groups with various credit schemes, which help in their economic empowerment. The research paper analyses the role of self-help groups in women's empowerment in the Mundgod and Hangal taluks in Northern Karnataka. The results show positive results in strengthening the economic welfare of self-help groups in the study areas. It has not only created sustainable employment but also helped to increase their monetary standards. Women lead the SHG movement, with over 99% of the groups made up of female members. This study takes a descriptive approach, using insights from field surveys conducted in the selected districts. It aims to explore the different jobs and employment opportunities that SHGs help create. Ultimately, SHGs provide a collective space where women can identify their strengths, use local resources, and engage in various economic activities.

KEYWORDS: ***Self-Help Groups, Empowerment, Sustainable Employment***

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1. INTRODUCTION

The Self-Help Group (SHG) is a small group of women who combine their savings through regular contributions. Over time, SHGs have become important micro-finance institutions that provide financial support and help build solidarity among members. They bring women together to tackle issues related to health, nutrition, gender equality, and social justice.

SHGs have significantly helped rural women develop entrepreneurial skills by improving their abilities and offering chances to take part in small business activities. The loans from SHGs are usually small, frequent, and short-term, making them easy for members to access.

This study looks at three main districts where SHGs are very active, with Uttar Kannada being a key area of focus. SHGs are formed voluntarily by rural and urban poor women who come together to save, create a common fund, and lend to each other based on group decisions, all to improve the social and economic conditions of their families.

Since their humble start in 1992, SHGs have expanded rapidly within India's microcredit scene. From just 255 savings-linked SHGs in 1992–93, the number grew dramatically to savings-linked groups amounting to ₹65,089.5 crore in 2024, according to NABARD's latest data. Besides providing financial help, SHGs also offer access to social welfare programs, training sessions, and capacity-building activities.

2. REVIEW OF LITERATURE

- Women's empowerment is a critical aspect of social and economic development, and self-help groups have emerged as a potent tool to achieve this goal. In the context of empowerment, women's development is a way of describing, stimulating, and overcoming the difficulties in the life of a woman through which she increases her ability to shape her life and environment. (Amutha & Hemalatha, 2018) The formation of self-help groups has been instrumental in providing women with access to financial resources, skill development, and social recognition, thereby enhancing their socio-economic status (- et al., 2017; Amutha & Hemalatha, 2018)
- Basak and Chowdhury (2024) conducted an empirical study in the Cooch Behar District of India, highlighting the impact of SHGs on women's socioeconomic development and their contribution toward achieving Sustainable Development Goals (SDGs) especially SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-being), SDG 4 (Quality Education), and SDG 5 (Gender Equality) of the United Nations. The study of 400 SHG members revealed significant improvements in participants' socioeconomic status and their level of awareness. Participation in SHGs significantly helped the rural women in economically disadvantaged communities, with their savings and by initiating entrepreneurial undertakings. Membership in SHGs and access to microcredit empowered women to establish small businesses, gather savings, and move with greater flexibility for work, thereby strengthening their decision-making power and self-confidence, which promoted their overall self-esteem.
- Another study conducted by Ghosh et al. (2024) analysed the impact of SHG participation and improvement of entrepreneurial behaviour among rural women, aiding their empowerment. Analysing through linear regression on data derived from 344 SHG members engaged in income-generating activities, the study confirmed that SHG interventions positively influence both economic and socio-cultural empowerment of rural women. The findings reinforce that entrepreneurial traits fostered within the SHG framework are as crucial a means of empowerment and social transformation, particularly in rural settings.
- The research works of Ranjula Bali Swain and Fan Yang Wallentin have contributed important insights into the long-term and regionally diverse impacts of SHGs in India. Swain and Wallentin (2009), in their empirical study, by using quasi-experimental household sample data collected from five Indian states, examined the empowerment outcomes among SHG members versus non-members.

Their study results revealed a statistically significant increase in women's empowerment among SHG members between 2000 and 2003, particularly in terms of challenging traditional gender norms.

- Further to their work, Swain and Wallentin (2012) used a structural equation model (SEM) to identify economic factors as the most influential in strengthening women's empowerment, although autonomy and social attitudinal changes also played significant roles. In a more nuanced study from survey data collected from five states in India, Swain and Wallentin (2017) found that regional variations exist; empowerment of women in southern states of India dominantly resulted from economic factors, whereas for the other states, decision-making autonomy, network, communication, and political participation were more significant.
- Broadening the framework, Anand et al. (2020) analysed over 6,000 SHG women members across all the 32 districts in Uttar Pradesh, one of India's poorest states, using a number of propensity score matching models. The results of the empirical study indicated that SHG participation significantly enhanced capabilities based on measures of life quality across a wide range of dimensions, particularly among marginalised caste groups.
- In the systematic review by Brody et al. (2017), compiled findings from a broad spectrum of SHG programs across low- and middle-income countries in South Asia. The analysis indicated that SHGs had positive effects on economic empowerment, resulting in financial decision-making and income generation, political empowerment through community participation, and mobility.
- The reviewed literature reveals that there exist different levels of positive impact of SHGs and the SHG-Banking Linkage Program (BLP) on women's empowerment and sustainable development in India. Several researchers have examined different aspects of women empowerment i.e. economic, social, political, and cultural; and how these efforts have strengthened those dimensions. Paltasingh (2014) studied the promotion of the SHG-bank linkage model as well as the constraints of its implementation, and policy suggestions are made to improve the efficacy of such programmes. Munivenkatappa (2014) evaluated NPO interventions in Mysore district, linking women's empowerment with environmental management. A field study conducted by Eswaraiah (2014) in Ananthapuramu district of Andhra Pradesh exposed the contribution of SHGs to women's empowerment in income, social status and family decision-making.
- Studies also shed light on some historical and conceptual dimensions of the SHG-BLP. The SHG programme was launched in the 1990s through a tripartite agreement among NABARD, NGO's and banks to provide formal financial services to the SHGs. Anowarul Islam et al. (2021), Jasmin et al. (2021) confirm that SHGs have contributed to raising women's socio-economic status, women's entrepreneurship and their empowerment. They, however, also underline some difficulties faced by group members, like a lack of management and training skills, credit policy & linkage with market availability.

The literature review underlines the need to research the ecosystem around the SHGs toward the specifics of who the constituents are, their roles and the various dimensions that women's empowerment takes.

3. OBJECTIVES

1. To understand the occupational pattern of members of SHGs in the study area.
2. To evaluate the operational function of the self-help groups and their role in the creation of employment.
3. Analyse the causal relationship between employment through SHGs activities and women's empowerment

4. SIGNIFICANCE OF THE STUDY

The Self-Help Group (SHG) movement has significantly changed the socio-economic status of women. It has helped women gain financial independence and achieve upward social mobility.

The main goal of SHGs is to reduce poverty by generating income through productive and sustainable activities. The Government of India provides strong support for SHGs, especially those led by women, by offering micro-credit programs that encourage small investments and entrepreneurship. In rural areas, SHGs mainly help their women members by providing credit, which works as a revolving fund to help them deal with financial challenges. While this credit can be used for everyday household needs or social obligations, the best use is in starting small businesses that promote self-employment and create more job opportunities. Beyond economic benefits, SHGs often address social issues like domestic disputes, family unemployment, and other community concerns. Members frequently rely on the group's common fund to handle personal or family crises.

This study aims to look at how SHGs create job opportunities, support small business startups, and contribute to wider social and economic improvements.

5. METHODOLOGY

The present study is empirical in nature, based on the primary data obtained from the field. The primary data is collected from the respondents through the interview schedule. Both descriptive analysis and inferential analysis were done to throw more light on the study. A sample of 167 questionnaires was obtained from the Mundgod and Hangal taluk of the Uttara Kannada district. These taluks were taken mainly due to the existence of many self-help groups working in these taluks.

Sampling - A Convenient Random sampling technique is adopted for the study.

6. DATA ANALYSIS & INTERPRETATION

The study areas, namely Mungod and Hangal taluks, are located in the Uttara Kannada district of Karnataka. The occupations of people involved were mostly migratory in nature. A vast majority of the respondents were women (86%). Only around 14 respondents were men. In the sample area, it was observed that the respondents were spread across low, middle and high age groups. One third of the female respondents were in the lower age groups, comprising 32 per cent of the total sample. Middle age comprised 29 per cent, followed closely by higher age groups with 27.5 per cent.

Table -1: Gender

Gender distribution	Number	Percentage
Female	143	85.63%
Male	24	14.37%
Grand Total	**167**	**100.00%**

Table 2: Average age

Gender	High	Middle	Low	Grand Total
Female	22.76%	29.94%	32.93%	85.63%
Male	4.79%	3.59%	5.99%	14.37%
Grand Total	**27.55%**	**33.53%**	**38.92%**	**100.00%**

Table -3: Occupation Pattern

Occupation	Female	Male	Grand Total
Agricultural Labour	68.86%	12.57%	81.43%
Brick making	0.00%	1.20%	1.20%
Construction Works	1.20%	0.00%	1.20%
Home maid	4.19%	0.00%	4.19%
Others	8.38%	0.60%	8.98%
Petty shops	1.20%	0.00%	1.20%
Poultry shop	1.80%	0.00%	1.80%
Grand Total	**85.63%**	**14.37%**	**100.00%**

From Table 3, it is observed that a vast majority of the respondents, 81% of them, were agricultural labourers. Two-thirds of them were women. Four per cent of them were housemaids, among women. A very small percentage had petty shops and poultry shops. Among men, 12.6 per cent were agricultural labourers. There are very small percentages in Brick making and others. The nature of occupation in table 4 reveals that more than 30 per cent were in temporary jobs, 28 per cent in permanent jobs and around 20 per cent in seasonal jobs. Eight per cent of the male respondents worked in permanent jobs. This clearly indicates that a large percentage of the respondents do not have a regular income of their own.

Table -4: Nature of employment

Nature of employment	Female	Male	Grand Total
Permanent	28.74%	7.78%	36.52%
Seasonal	19.76%	0.00%	19.76%
Temporary	31.14%	6.59%	37.73%
Nil	5.99%	0.00%	5.99%
Grand Total	**85.63%**	**14.37%**	**100.00%**

Table -5: Income levels

Average income	Female	Male	Grand Total
High	21.56%	1.20%	**22.76%**
Low	24.55%	13.17%	**37.72%**
Medium	39.52%	0.00%	**39.52%**
Grand Total	**85.63%**	**14.37%**	**100.00%**

The occupations undertaken by the respondents were temporary, and a sizable percentage had seasonal employment. The income analysis shows that 60 per cent of them have low to medium average income. A mere 27.55 per cent of them fell into the high-income category. It is also noted that most of their work was seasonal and not permanent.

Table -6: SHG membership

Self-help groups	Female	Male	Grand Total
No	13.17%	6.59%	19.76%
Yes	70.66%	7.78%	78.44%
Grand Total	**85.63%**	**14.37%**	**100.00%**

Women respondents form a major percentage of the self-help groups in the rural areas, according to many studies. This is also reflected in the above study, with a vast majority of the 85 per cent of the groups comprising women members. The male respondents comprised only 14 per cent of the total membership in both the taluks.

In Table 4, it was found that self-help groups in the study area provide help of different natures. Self-help groups have directly and indirectly provided them with employment and avenues for employability. A sizable percentage have taken up training in tailoring (35%), seventeen per cent have undertaken training for self-employment through government schemes, seven per cent in sheep rearing and a small one per cent in agarbathi, papad making and beautician courses. This goes to show that a sizable percentage of women join self-help groups to obtain monetary support and empowerment through employability.

The self-groups, though initially stated as social groups working to promote social welfare among migrant communities, have changed their operational functions in the rural areas. They have modified their way of functioning. The analysis shows that training for members has been initiated in various income generation schemes. Women have been trained in various training, like agarbathi (1.2%), papad making (1.8%), sheep rearing (7.78%), and tailoring (35.93%). Thus, it can be seen that female

members form a large part of the training program offered by the self-help groups and that a significant percentage of them have obtained training in those areas that can lead to their future employment. Male members have trained themselves in panchayat work, but women have not obtained training in societal or panchayat welfare schemes.

Table -7: Type of training

Type of training	Female	Male	Grand Total
Agar Bathi making	1.20%	0.00%	1.20%
Applying Government schemes	18.56%	0.00%	18.56%
Awareness of health-related issues	6.59%	0.00%	6.59%
Beautician course	0.60%	0.00%	0.60%
Education opportunities	0.00%	0.60%	0.60%
Leadership/ Marketing/ Branding/ Soft skills/Bookkeeping	0.00%	0.60%	0.60%
Panchayat entitlement	0.60%	0.60%	1.20%
Papad making	1.80%	0.00%	1.80%
Sheep rearing	7.78%	1.20%	8.98%
Societal entitlement	0.00%	4.18%	4.18%
Tailoring	35.93%	7.19%	43.12%
Nil	12.57%	0.00%	12.57%
Grand Total	**85.63%**	**14.37%**	**100.00%**

Table -8: Employment through self-help groups.

Employment through Self-help groups	Female	Male	Grand Total
Agriculture	1.20%	0.00%	1.20%
Brick Making	0.00%	0.60%	0.60%
Cattle Rearing	4.19%	8.98%	13.17%
Construction	9.58%	4.19%	13.77%
Fishing	0.60%	0.00%	0.60%
Helper	1.80%	0.00%	1.80%
Labourer	1.80%	0.60%	2.40%
MNREGA	3.59%	0.00%	3.59%
Papad Making	0.60%	0.00%	0.60%
Petty Business	4.78%	0.00%	4.78%
Self-Employment	0.60%	0.00%	0.60%
Social Work	0.60%	0.00%	0.60%
Tailoring	2.40%	0.00%	2.40%
Nil	53.89%	0.00%	53.89%
Grand Total	**85.63%**	**14.37%**	**100.00%**

The self-help groups in the study area have also been providing support to members by providing employment. These employment avenues were created by them through contacts, by word of mouth or by self-generating business ventures. Although a very small percentage of members have been provided employment, the number continues to increase steadily. Ten per cent of members are employed in the construction sector, 1.2% in the agricultural field, in tailoring (2.4%), and as labourers (1.8%), with 4.78% engaged in petty business. A small percentage, that is, 3.6 per cent of them, have obtained employment in the MNREGA schemes through

Table 9: Loans through Self-help groups

Purpose of Loan (SHG)	Female	Male	Grand Total
Buy a sheep/cow	1.20%	0.60%	1.80%
Agricultural purpose	26.35%	4.18%	30.53%
Construction of a house	11.78%	0.00%	11.78%
Education	5.98%	6.59%	12.57%

Education, Agricultural purpose	9.58%	0.60%	10.18%
Education, Construction of a house	7.19%	0.00%	7.19%
Education, to buy a sheep/cow	0.60%	0.00%	0.60%
Education, a Petty shop	0.60%	0.00%	0.60%
Education, Poultry	7.78%	0.00%	7.78%
Petty shop	4.39%	1.20%	5.59%
Poultry	4.79%	1.20%	5.99%
Nil	5.39%	0.00%	5.39%
Grand Total	**85.63%**	**14.37%**	**100.00%**

The main motivation of women to join self-help groups is to obtain loans through the joint credit system, where members pool in a small amount of money every month and the pooled in money can be used by any member and a very small percentage of interest is charged, which is divided among members or goes into the pooled in reserve to be utilised in the future. Table 9 shows that female respondents have utilised the loans for multiple purposes and also utilised them for further investment. It was seen that 26.35% of them have utilised it for agricultural purposes like cultivating lands, 11.78% for constructing houses and 6.98% for education. Around 4.39% of them have taken loans for petty shops and for purchasing poultry (4.79%). It was seen that nearly 23 per cent of the women have taken loans for multiple purposes. The male members, though they comprise a small percentage, have utilised the loans for agricultural purposes, for petty shops or for poultry business. Though self-help groups give a small amount of money as loans, it has been utilised by members in a major way to obtain economic gains.

7. HYPOTHESIS TESTING

1. H_0 – There is no relationship between Employments through SHG's and Gender.
   H_1 – There is a relationship between Employment through SHGs and Gender.

Type of Employment (O - Observed Value)			
	Employment	**No Employment**	**Grand Total**
Female	119	23	**142**
Male	21	5	**26**
TOTAL	**140**	**27**	**167**

Type of Employment (E - Expected)		
	Employment	**No Employment**
Female	119.0419162	22.95808383
Male	21.79640719	4.203592814

Type of Employment ((O-E)^2/E)		
	Employment	**No Employment**
Female	1.47592E-05	7.65293E-05
Male	0.029099493	0.150886262
X^2	0.180077043	
df	1	
p-value	0.671307039	

From the above table, it is observed that the calculated value is 0.67, which is greater than the Table Value; hence, it is concluded that there is a relationship between Employment through SHGs and Gender. The facilities provided by SHGs are mainly used by the women in the study area, and they are able to get highly employed in comparison to men.

2. H_0 – There is no relationship between Loan Taken from SHGs and Gender.

H_1 – There is a relationship between loans taken from SHGs and Gender.

Loan from SHG's (O - Observed Value)			
	F	**M**	**Grand Total**
Loan Taken	132	22	154
No Loan	7	2	9
	139	28	167

Loan from SHG's (E - Expected)		
	F	**M**
Loan Taken	128.1796	25.82035928
No Loan	7.491018	0.107784431

Loan from SHG's ((O-E)^2/E)		
	F	**M**
Loan Taken	0.113865	0.565257241
No Loan	0.032185	33.21889554
X^2	33.93020258	
df	1	
p-value	5.71E-09	

From the above table, it is observed that the calculated value is greater than 0.5; hence, it is said that there is a relationship between loans taken from SHGs and Gender. The short-term loans provided by SHGs are mainly taken by women in the study area to get themselves trained and start small-time businesses to earn their living, rather than men.

8. SUMMARY AND CONCLUSION

The nature of the self-help groups, which were once formed to bring about social reformation among member groups, has undergone a major transformation. They have changed over the decades. The above analysis was done using an interview conducted among a group of one hundred and sixty members. Most of the women respondents were in agricultural labour, which was temporary and seasonal in nature. The majority of them were at low- and medium-income levels. The vast majority of the women were members of one group or the other. A sizable percentage of them have obtained training offered by the self-help groups to obtain employment and to strengthen employment prospects, enhancing their economic empowerment. The results show that the SHGs in the study area have employed members in a significant manner. The loans offered by the self-help groups have been well utilised by the members been as a substantial percentage of them have utilised them to take care of their monetary needs. The study shows that the operational functions of the self-help groups have undergone a sea change in the rural areas. By providing proven training programs, offering credit facilities, they have channelised women's workforce to obtain employment, strengthening their economic viability and empowering them.

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GREEN SOFTWARE GOVERNANCE: ORGANIZATIONAL STRATEGIES FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT:
The problem of sustainability is very vital in software governance as with the rapid growth of digital systems, the environmental consequences of software-based businesses have significantly grown. Green software governance is a strategic plan that involves integrating environmental sustainability into IT management systems, software engineering processes and organizational decision-making. To ensure sustainable development without compromising operational efficiency and technical innovation, this article explores the way businesses can adopt the green software governance practices. This paper considers governance systems including lifecycle-based software management tools, carbon footprint frameworks, energy conscious software design criteria, and sustainability conscious policies. It highlights that to implement an environmental responsibility into software engineering and IT operations, the leader must be committed to it, ensure cross-functional collaboration, and sustainability indicators. Another issue that the article discusses is that corporate social responsibility, regulatory compliance, and environmental, social, and governance (ESG) objectives are all consistent with green software governance. To reduce the energy and resource usage of the overall software systems, the organizational efforts are particularly considered such as green DevOps, cloud optimization, sustainable procurement and employee capacity building. Some of the gaps that are addressed by the paper in the implementation of green software governance are the absence of standardized measures, the unwillingness of organizations to change, and the trade-offs between sustainability and performance. The research provides a theoretical model of integrating the green software governance into the organization strategy through an amalgamation of potentially optimal research and practice. It argues that the realization of sustainable environmental development, increasing organizational resilience, and progressive sustainable global development aims all require the effective management of sustainable software systems. Green software governance is finally placed as an essential facilitator of the responsible digital transformation in the era of sustainable innovation.

KEYWORDS: ***Green Software Governance; Sustainable Software Engineering; Organizational Strategy; Digital Sustainability; ESG Goals; Green IT; Sustainable Development***

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1. INTRODUCTION

The rampant spread of digital technology has radically transformed the system of governance, service delivery model, and organisational practices in all industries. Software systems are now driving the process of critical processes such as communication, data analytics, automation, and decision-making. Environmental impact Software development and use has increased in significance as software intensive systems become increasingly more relied upon by business [1].

To address these concerns, the concept of green software governance has emerged as a tool of integrating the sustainability concepts strategically in organisational and software engineering decision-making. Green software governance aims at offering frameworks, policies and accountability systems that guide the development, deployment and maintenance of software systems in an environmentally responsible manner [2]. By balancing between technological innovation and ecological responsibility through the addition of sustainability to the governance structures, organisations can make a contribution to long-term sustainable development objectives[3][4].

1.1 Background and Rationale

With the global focus on sustainability and climate action, organisations are reconsidering the environmental implication of their digital ecosystem. Although renewable energy use and hardware efficiency have been the topic of much discussion, the role of software in energy consumption has often been overlooked [5]. Poorly optimised cloud installations, redundant procedures, data storage that is not necessary, and ineffective algorithms are the main causes of increased energy consumption and carbon footprints[6].

Green Software Governance meets this requirement by means of systematic supervision and strategic guidance of sustainable software activities. It has a governance-based approach to ensure that the factors of sustainability are factored in the software development life cycle at every step. The increasing interests in understanding how governance systems may affect organisational behaviour, promote responsibility, and deliver measurable sustainability outcomes are the reasons behind the choice of this study. This research aims at helping organisations to integrate their software practices into environmental, social, and economic sustainability ambitions by examining governance approaches [7].

1.2 Need for Green Software Governance

The increasing complexity of software systems and their tremendous influence on energy consumption in the world need green software governance. Software proliferation is uncontrollable and may lead to inefficiencies, wastage of resources, and a rise in the operating costs as companies scale up their digital operations [8]. In the traditional governance systems, performance, security and compliance often receive the first priority and sustainability is a secondary consideration.

Green software governance ensures that the corporate software policies and decision-making processes integrate environmental concerns. It assists companies in tracing carbon emissions of the software use, establish the standards of energy-efficient design, and promote sustainable innovation [9]. Moreover, governance structures enhance business social responsibility, regulatory compliance and organisational reputation. Green software governance is no longer an option as it is a strategic requirement in consideration of global sustainability pledges and evolving environmental limitations.

1.3 Objectives of the Study

The key objectives of the study are as follows:

- To explore the concept of Green Software Governance and its relevance in modern organisations.
- To study the governance practices and organisational approaches that facilitate software development which is sustainable.
- To identify the most significant performance measures and measures to derive software sustainability.

- To explore the barriers and challenges associated with the application of green software governance.
- To provide recommendations on how the organisational software governance frameworks ought to integrate the principles of sustainability.

2. Conceptual Framework of Green Software Governance

Green Software Governance conceptual framework aims at aligning technical progress, administrative decisions, and policy development with the environment [10]. To ensure that software systems are designed and operated in a manner that is ecologically responsible, the framework in Figure 1 indicates that governance mechanisms such as standards, regulations, accountability frameworks, and performance monitoring are very critical. Green Software Governance assists enterprises to lower the environmental footprint of digital technology without compromising productivity, scalability and value creation over the long term by considering the issue of sustainability during the software life cycle. Green software Software developed, created, implemented and maintained with the intention of minimizing its effects on the environment throughout the entirety of its life cycle is known as green software. It puts high values in resource responsibility, optimization of system architecture and energy efficient code practices[11]. In addition to technical optimisation, green software includes end-user behaviour, cloud deployment patterns, data management techniques, and the choice of infrastructure. Green software enhances the organisational performance and the sustainability of the environment through resource efficiency, carbon emission and energy consumption.

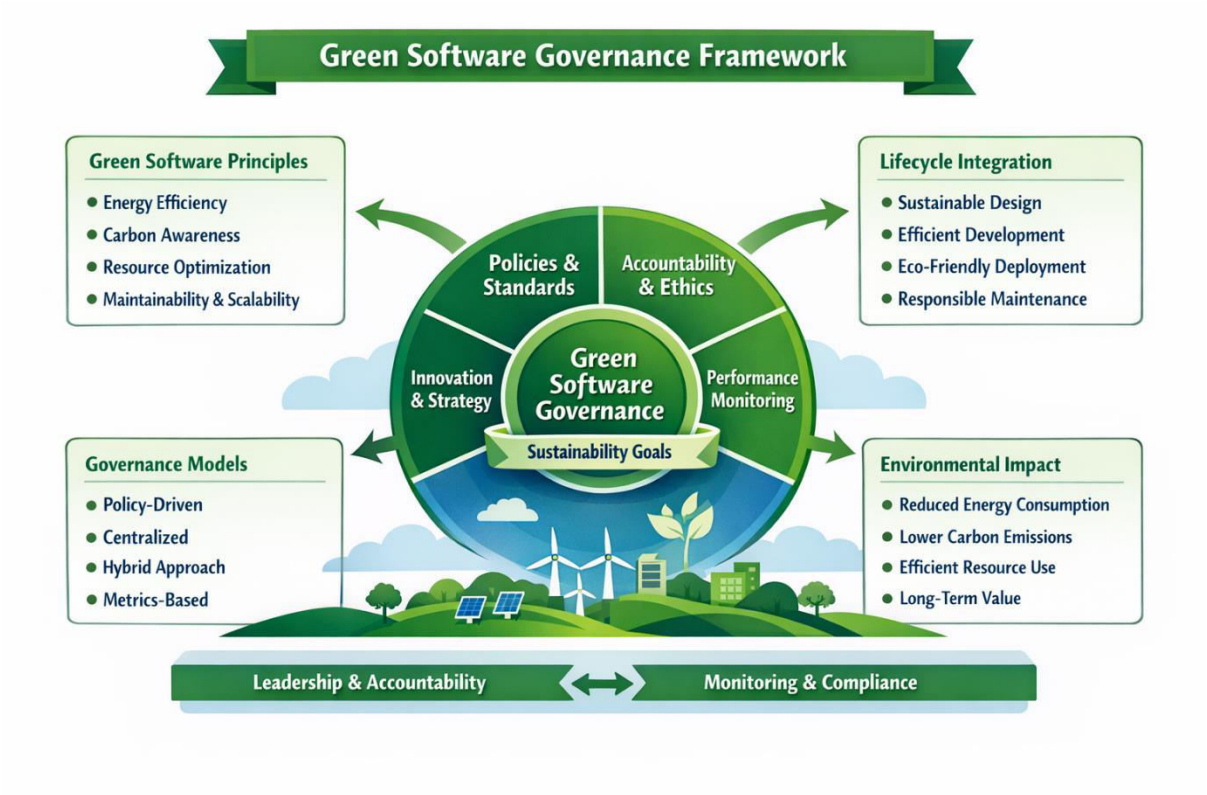

Figure 1: Green Software Governance Framework.

Software sustainability is based on fundamental concepts that can ensure the long-term social, economic, and environmental benefits [12]. These policies encompass development of scalable and maintenance systems, software aware of carbon in its operations, energy efficiency and optimal utilization of the computational resources. Sustainable software design encourages lifespan, flexibility and reuse in order to reduce waste and the necessity of frequent renovation[13]. The ethical and

responsible design principles also contribute to transparency, accountability and social responsibility in software systems [14].

Green software practices through sustainable IT governance models can form the structural basis of organisations to implement green software. These models define authority to make decisions, accountability, and criteria used to assess the sustainability of software. Policy-based, centralised, hybrid and metrics-based governance models are often applied to integrate sustainability goals in IT governance structures. Good governance has ensured cross-functional collaboration, leadership commitment, continuous monitoring, and adherence to sustainability and environmental regulations. Organisational support of even broader sustainable development objectives can be achieved through systematic incorporation of sustainability in organisation software plans by development of robust governance frameworks.

3. ORGANIZATIONAL STRATEGIES FOR GREEN SOFTWARE GOVERNANCE

Organisational approaches are needed in order to translate the ideas of green software governance into realistic and measurable processes. These strategies incorporate sustainability objectives into the process of operations, technical choices, leadership vision, and performance review systems. To ensure that sustainability is perceived as a constituent of digital transformation and a long-term value creation and not as an independent project, organisations can incorporate environmental concerns into the software governance models.

3.1 Policy Integration and Leadership Commitment

The initial steps to effective green software governance are strong commitment in leadership and integration of sustainability into organisational policy[15]. Strategic prioritization, resource distribution, and developing an environmentally-aware culture are all important undertakings of top management. Leadership commitment ensures that the goals of sustainability are aligned to the business plan, organisational mission and digital innovation agendas.

Policy integration standards give clear expectations of carbon reduction, energy efficiency and responsibility in the use of resources throughout the software life cycle. In addition, leadership-oriented policies promote accountability by defining functions, responsibilities, and decision-making power in regards to sustainable software practices. When sustainability is institutionalised with formal policies and backed by the leadership, it is easier to achieve the same and measurable environmental outcomes by the organisations.

3.2 Sustainable Software Development Life Cycle (SSSDLC)

The Sustainable Software Development Life Cycle (SSSDLC) builds upon the traditional software development models by incorporating environmental factors throughout its process, including requirements analysis and maintenance and retirement. The sustainability requirements such as energy efficiency, scalability and modularity have prior consideration in the planning and design stages to minimise the long term use of resources [16].

Energy-efficient coding habits, resource-conscious testing techniques, optimised algorithms and other techniques can also be used to reduce the amount of energy consumed and increase performance during the development and testing phases[17]. To minimize the environmental impact over time, the deployment and maintenance phases emphasize on the effective runtime behaviour, scalability and continuous optimisation. The SSSDL C approach can help organisations to enhance the durability of the software, reduce wastes and promote continuous sustainability performance enhancement.

3.3 Green Cloud and Infrastructure Management

The digital infrastructure and cloud computing have a significant effect on the environmental impact of software systems. The primary objectives of green cloud and infrastructure management practices are to deploy renewable sources of energy, optimise resources provisioning, and select data centres with less energy consumption. Organisations can reduce their carbon emissions by deploying

cloud providers who place sustainability at the frontline, offer task scheduling that is carbon aware and offer extensive environmental reporting.

With the help of infrastructure optimisation processes, such as virtualization, containerisation, and dynamic scaling, the available computer resources can be efficiently utilised by lowering idle capacity and energy waste [16]. The minimisation of data and sound data storage policies and minimisation of workloads also lead to reduced utilisation of energy. Green infrastructure management empowers the role of governance in responsible digital resource management through the coordination of operational competence with environmental objectives.

3.4 Tools and Technologies for Sustainable Software

Green software governance cannot be operationalized without the implementation of appropriate methods and technologies. Energy profiling and monitoring technologies can help organisations to analyse the usage of software energy, identify inefficiency and sustainability performance over time. Carbon accounting platforms are used to measure the emission regarding cloud computing, infrastructure deployment, and software operation[18].

The automation technologies, e.g. pipelines with continuous integration and deployment (CI/CD), can be supplemented with sustainability checks to ensure the compliance with green software standards. Moreover, the optimal programming languages and frameworks assist in sustainable software engineering methods through the use of performance- and efficiency-oriented programming languages and development frameworks. By using data-driven tools and emerging technologies, organisations can improve their transparency, improve well-informed decision-making, and continuously optimise software systems to enable environmental sustainability.

4. METRICS AND PERFORMANCE INDICATORS FOR GREEN SOFTWARE

The measurement of sustainability in the software systems requires well-define metrics and performance indicators that base the environmental goals on outcomes that can be observed and quantified. Whereas the amount of carbon emission measures the environmental effect of using energy, the amount energy consumption measures the efficiency of using computing resources by software[19]. In addition, software efficiency and resource optimisation measures evaluate the correlation between system performance and resource utilisation, and are concerned with waste minimisation, scalability and maintainability. These measurements together provide a systematic method of monitoring the performance of green software and enhancing accountability, governance, and sustained creation of green software. The Metrics and Performance Indicators of Green Software are shown in Table 1.

Table 1: Metrics and Performance Indicators for Green Software

Category	Metric Type	Description	Relevance to Green Software Governance
Energy Consumption Metrics [20]	Energy Usage (kWh)	Measures the total electrical energy consumed by software applications during execution, including processing, memory, and storage operations.	Enables monitoring of software energy efficiency and identification of high-consumption components.
	Power Utilization Effectiveness (PUE)	Evaluates data center energy efficiency by comparing total facility energy usage to IT equipment energy consumption.	Supports governance decisions related to infrastructure and cloud provider selection.
	CPU and Memory Energy	Assesses energy consumed by CPU cycles, memory	Helps optimize software design and improve

	Profile	allocation, and input/output operations.	resource-efficient coding practices.
	Idle vs. Active Energy Ratio	Compares energy usage during idle states versus active execution.	Encourages adaptive scaling and efficient runtime management.
Carbon Emission Measurement[21]	Carbon Intensity (gCO_2/kWh)	Measures carbon emissions per unit of electricity consumed, based on energy source.	Enables carbon-aware scheduling and deployment decisions.
	Software Carbon Footprint	Calculates total emissions generated by software operations across its life cycle.	Provides a holistic view of environmental impact for governance reporting.
	Cloud Carbon Emissions	Measures emissions associated with cloud workloads and data transfers.	Supports sustainable cloud governance and provider benchmarking.
	Emission Reduction Rate	Tracks the percentage reduction in emissions over time.	Assesses the effectiveness of green software strategies and policies.
Software Efficiency and Resource Optimization Indicators [22]	Resource Utilization Rate	Measures the percentage of CPU, memory, and storage resources actively used.	Identifies over-provisioning and supports efficient resource allocation.
	Execution Efficiency	Evaluates performance output relative to energy and resource input.	Promotes high-performance, low-energy software solutions.
	Code Efficiency Index	Assesses algorithmic efficiency and computational complexity.	Encourages maintainable and optimized software design.
	Scalability Efficiency	Measures how efficiently software scales under varying workloads.	Supports sustainable growth without proportional increases in resource con

5. CHALLENGES AND BARRIERS IN IMPLEMENTATION

Various challenges face the implementation of green software governance, such as organisational, technical, and measurement, among others. Technically, modern software systems are becoming more complex, and are often built on layered cloud systems and legacy systems, which do not allow a look into environmental impact and energy consumption. In the event that software optimisation aimed at energy efficiency conflicts with the objectives of sustainability and the performance, scalability or reliability of organisations, it can be difficult to find a balance between the two[23]. Lack of software-level tool support of fine-grained energy and carbon measurement also limits competent implementation.

Organisational and cultural issues are also very detrimental to adoption. The cost, speed and functionality are perceived as more significant than the sustainability and this leads to poor prioritisation in the software development processes. Knowledge deficiency, insufficient training, change resistance and departmental accountability may hinder the integration of the concepts of

sustainability in governance structures. Without a robust level of leadership commitment and accountability processes, green software projects often remain as ad hoc, as opposed to institutionalised practice [24].

Measurement and standardisation are problems that make green software governance more challenging. Without well recognised metrics, benchmarks and reporting standards, it is difficult to compare sustainability performance between the various projects or organisations and determine performance in a consistent manner. The differences in the methods of measurements, access to the data and interoperability of the tools limit transparency and the integration of green software metrics into ESG reporting, regulatory compliance, and strategic decision-making [25]. These problems need to be addressed so that the systematic, scalable, and quantifiable approach to green software governance is possible.

Figure 2: Challenges in Implementing Green Software Governance

6. CONCLUSION

Green software governance is a business and strategic necessity in a digital transformation and sustainability age. The effect of software systems on the environment cannot be overlooked as they have remained essential in driving business with the use of resources, consumption of power, and release of carbon dioxide. This paper highlights that to align organisational activities with long term environmental, social and economic objectives, software governance models need to have concepts of sustainability.

Governance-based approaches, such as integrating policies, committing leadership, Sustainable Software Development Life Cycle (SSSDLC), green cloud management, and technologies that are sustainability-oriented can help organisations systematically reduce the environmental impact of their software systems. Measures and performance indicators such as energy use, carbon emissions, resource use, and software performance are needed in order to gauge improvement, encourage accountability, and guide continuous improvement.

Although the benefits are quite evident, the widespread challenge of adopting green software governance is because of the organisational resistance, technology complexity as well as lack of

standardised measurement standards. These barriers can be overcome through leadership commitment, cross-functional cooperation, capacity building, and introduction of the standardized sustainability metrics to make sure that the results are the same, transparent, and scaleable.

Finally, green software governance can assist companies to create a balance between the environmental responsibility and technical innovation. By incorporating sustainability into the core of software development and IT operations organisations can enhance their operational efficiency and resilience and contribute to the global sustainable development goals significantly. With the increasing growth of digital systems, green software governance will be a major enabler of responsible, sustainable, and progressive digital transformation.

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THE IMPACT OF DIMENSION OF ACCREDITATION ON ACADEMIC ENVIRONMENT IN HIGHER EDUCATION INSTITUTIONS

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ABSTRACT:
Higher education serves as a vital pillar for a nation's development across social, economic, cultural, scientific, and political domains. It equips individuals with the capabilities to transition from merely being human to becoming valuable human resources. In the era of globalization, the demand for high-quality higher education has intensified, emphasizing the need to foster creativity, innovation, adaptability, and a research-oriented mindset. The main objective of this study is to assess the impact of each dimension of accreditation on the academic environment. One of the key mechanisms to ensure this quality is accreditation—a robust process of quality assurance. This study examines the key institutional factors that influence the academic environment in higher education institutions, with a focus on assessing both the strength of structural relationships and the model's predictive accuracy. Using a quantitative approach involving a survey of faculty members, the study reveals significant relationships between the accreditation dimensions and academic performance indicators. The results reveal that constructs such as Innovative Value-Based Practices, Institutional Learning Resources, Student Support Practices, and Curriculum Alignment significantly contribute to the development of a robust academic environment. Conversely, Governance and Leadership Mechanisms and the Teaching-Learning Environment were found to have limited impact. The model demonstrates strong explanatory power for academic environment. The findings offer practical implications for policymakers and educational leaders seeking to strengthen academic quality and support accreditation efforts through strategic institutional improvements.

KEYWORDS: ***Accreditation, Academic Environment, Quality Assurance, Higher Education, Institutional Governance***

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1. INTRODUCTION

Accreditation serves as a benchmark for evaluating the quality of educational institutions, promoting standardization, and enhancing public confidence in higher education systems. In India, organizations like the National Assessment and Accreditation Council (NAAC) assess higher education institutions (HEIs) on several dimensions to ensure institutional effectiveness and academic excellence (NAAC, 2020). These bodies assess higher education institutions (HEIs) based on a comprehensive set of criteria ranging from curricular aspects and teaching-learning processes to research output, infrastructure, and institutional governance (NAAC, 2020). NAAC's framework, in particular, has emphasized a shift from mere input-based evaluation to a more outcome-based, student-centric assessment. Despite its increasing relevance, the specific influence of accreditation dimensions on academic environments remains underexplored. This study aims to bridge that gap by examining how different accreditation criteria impact institutional academic settings. Accreditation in higher education is a critical quality assurance mechanism aimed at evaluating, certifying, and continuously improving the standards of academic institutions. It plays a pivotal role in promoting accountability, enhancing institutional credibility, and ensuring that educational offerings align with national and global expectations of quality and relevance (Harvey, 2004). As higher education becomes increasingly competitive and globalized, accreditation has evolved into a strategic instrument for institutional benchmarking and public assurance.

Globally, accreditation is recognized as a formal process through which independent agencies assess educational institutions against predetermined standards, encompassing various dimensions such as curriculum quality, faculty competence, infrastructure, governance, and student support (Stensaker, 2008). These evaluations are essential not only for recognizing institutional effectiveness but also for driving improvements in pedagogical practices and fostering a culture of continuous innovation. Accreditation is also integral to ensuring public trust and regulatory compliance in higher education. According to Altbach (2005), accredited institutions are perceived to be more transparent, accountable, and responsive to the needs of society. Moreover, accreditation status often determines access to government funding, research grants, academic collaborations, and student mobility opportunities. It serves as a quality marker that influences institutional ranking, stakeholder perceptions, and student enrollment patterns (Singh & Srivastava, 2018).

Despite its benefits, accreditation processes are not without challenges. Institutions often struggle with bureaucratic rigidity, a lack of internal quality systems, and resistance to reform (Brennan & Shah, 2000). However, when implemented effectively, accreditation fosters a robust academic ecosystem, encourages reflective practices, and promotes institutional sustainability in the long run. Thus, in the contemporary landscape of higher education, accreditation is more than a compliance requirement—it is a transformative process that shapes institutional identity, enhances academic integrity, and drives excellence through systematic evaluation and reform.

1.1 Academic Environment

The academic environment refers to the overall intellectual, physical, social, and emotional conditions within an educational institution that collectively shape the learning and teaching experience. It encompasses various dimensions such as faculty quality, institutional culture, infrastructure, governance, student engagement, and support services. A conducive academic environment not only fosters academic achievement but also enhances critical thinking, innovation, and holistic development among students and faculty (Astin, 1993). At the core of the academic environment is the interaction between students and educators. Faculty competence, teaching methodologies, and openness to feedback significantly influence student learning outcomes. Institutions that encourage pedagogical innovation, interdisciplinary approaches, and collaborative learning tend to create more vibrant and inclusive academic cultures (Altbach, 2005). Moreover, the presence of qualified, motivated, and research-oriented faculty members contributes directly to academic excellence and the institution's reputation (Harvey & Green, 1993). Physical infrastructure—such as libraries, laboratories, classrooms, and digital resources—also plays a critical role in shaping the academic climate. Adequate infrastructure facilitates

smooth academic operations and enables students to access necessary learning tools (Tight, 2004). Similarly, institutional governance, leadership practices, and policy frameworks impact the transparency, autonomy, and responsiveness of academic systems (Brennan & Shah, 2000).

In addition to teaching and infrastructure, the research culture within a higher education institution significantly affects the academic environment. Encouraging faculty and students to engage in research, participate in conferences, and publish scholarly work contributes to an intellectually stimulating atmosphere (Stensaker, 2008). Research-driven environments also tend to attract more funding, academic collaborations, and international recognition. Furthermore, the academic environment is influenced by student support services such as counseling, mentoring, career guidance, and grievance redressal mechanisms. When students feel supported emotionally, socially, and academically, their engagement, retention, and performance improve (Tinto, 1993). The promotion of ethical practices, inclusivity, gender sensitivity, and sustainability within campuses also reflects an institution's commitment to creating a value-driven academic ecosystem (NAAC, 2020). It is important to note that the academic environment is dynamic and evolves with changes in institutional policies, technological advancements, and societal expectations. Therefore, continuous assessment and improvement of this environment are essential for maintaining educational relevance and quality.

1.2 Dimension of Accreditation

Accreditation has become a pivotal mechanism in ensuring the quality and accountability of higher education institutions (HEIs) across the globe. As global education systems evolve, the need for reliable quality assurance frameworks intensifies, and accreditation serves as a formal recognition that an institution or program meets defined standards of educational quality (Stensaker & Harvey, 2011). Within this process, the concept of "dimensions of accreditation" has emerged as a foundational element, referring to the critical areas assessed during the evaluation process. These dimensions often encompass institutional mission and governance, faculty credentials, curriculum design, student support services, infrastructure, research output, financial stability, and continuous improvement mechanisms (CHEA, 2021; Vlăsceanu et al., 2007).

The multidimensional nature of accreditation reflects the complexity of quality assurance in education. Each dimension plays a significant role in not only signaling institutional credibility but also in driving performance improvement and public accountability (Harvey & Newton, 2007). For example, curriculum standards and learning outcomes are closely scrutinized to ensure relevance and alignment with current academic and industry trends (Altbach et al., 2009). Similarly, the evaluation of faculty qualifications and research contributions ensures academic rigor and innovation within the institution (Salmi, 2009). These dimensions provide a structured basis for decision-making by stakeholders, including students, employers, policymakers, and funding agencies. NAAC's accreditation criteria encompass a wide array of dimensions: (1) Curricular Aspects, (2) Teaching-Learning and Evaluation, (3) Research and Innovation, (4) Infrastructure and Learning Resources, (5) Student Support and Progression, (6) Governance and Leadership, and (7) Institutional Values and Best Practices. According to Singh & Srivastava (2018), these dimensions collectively contribute to holistic institutional development.

Given the increasing emphasis on outcome-based education, most accrediting agencies globally have expanded their frameworks to assess institutional effectiveness through quantifiable indicators. As such, understanding and evaluating the specific dimensions of accreditation is vital for institutional self-assessment, continuous quality enhancement, and strategic planning (Schindler et al., 2015). This growing importance has led many HEIs to develop internal quality assurance mechanisms aligned with accreditation dimensions, fostering a culture of quality and accountability.

1.3 Relationship between Dimensions of Accreditation and Academic Environment

The relationship between the dimensions of accreditation and the academic environment is both integral and multidimensional. Accreditation is a quality assurance mechanism that evaluates higher education institutions (HEIs) across several key dimensions such as institutional governance, faculty

competence, curriculum relevance, research output, infrastructure, student support, and internal quality assurance systems (Vlăsceanu et al., 2007; CHEA, 2021). Each of these dimensions directly influences the academic environment by shaping the structural and functional aspects of teaching, learning, research, and student engagement.

A robust academic environment is characterized by intellectual rigor, innovation, academic freedom, inclusivity, and access to learning resources (Kuh & Umbach, 2004). Accreditation processes, through their evaluative dimensions, enhance these characteristics by enforcing standards that encourage continuous improvement. For instance, the dimension of curriculum design and learning outcomes promotes academic coherence and relevance, ensuring that students receive education aligned with current disciplinary and industry needs (Altbach et al., 2009). Similarly, the focus on faculty qualifications and research productivity elevates the academic discourse and contributes to a more intellectually stimulating environment (Salmi, 2009). The dimension of infrastructure and learning resources—often included in accreditation criteria—plays a significant role in supporting a conducive academic environment. Access to libraries, laboratories, digital tools, and safe physical spaces enhances both student and faculty performance (Schindler et al., 2015). Furthermore, internal quality assurance mechanisms as a key dimension foster a culture of self-reflection, feedback, and data-informed decision-making, which in turn improves the teaching-learning process and student satisfaction (Harvey & Newton, 2007).

Moreover, accreditation's emphasis on student support services, governance, and stakeholder engagement ensures that the academic environment is not only effective but also inclusive and responsive to diverse student needs (Stensaker & Harvey, 2011). Institutions that consistently perform well across accreditation dimensions are more likely to offer a dynamic, ethical, and globally competitive academic environment. In summary, the dimensions of accreditation function as critical levers for enhancing the academic environment. By systematically evaluating and guiding improvements in the key areas of academic operation, accreditation ensures that institutions foster environments conducive to learning, research, and holistic development.

2. REVIEW OF LITERATURE

The academic environment refers to the ecosystem within an institution that influences teaching quality, research productivity, student satisfaction, and institutional reputation (Astin, 1993). Previous studies have shown that institutional governance, faculty development, and infrastructural quality are crucial for fostering an academically enriching environment (Brennan & Shah, 2000; Altbach, 2005).

Accreditation is a structured process of evaluating higher education institutions (HEIs) against established benchmarks to ensure and enhance quality in academic and administrative practices. Various scholars have examined the dimensions of accreditation as defined by accreditation bodies, particularly the National Assessment and Accreditation Council (NAAC) in India, which has proposed a multi-criteria framework covering key areas essential to institutional excellence. Accreditation is a quality assurance mechanism designed to evaluate, monitor, and improve institutional performance (Stensaker, 2008). It involves a rigorous evaluation based on pre-determined criteria that reflect academic and administrative effectiveness (Harvey, 2004). NAAC (2020) emphasizes continuous improvement through periodic reviews.

The design, relevance, and flexibility of curricula are central to the accreditation process. NAAC (2020) emphasizes the importance of outcome-based education, regular syllabus revision, interdisciplinary integration, and alignment with employability skills. According to Singh and Srivastava (2018), an updated and dynamic curriculum enhances the relevance of academic programs and prepares students for contemporary challenges. This dimension assesses the effectiveness of the teaching-learning process, pedagogical innovations, teacher qualifications, and evaluation mechanisms. Stensaker (2008) notes that accreditation promotes reflective teaching practices and learner-centric approaches. Institutions with high accreditation scores often demonstrate better student engagement, faculty-student

interaction, and transparent assessment processes. Accreditation criteria increasingly stress the importance of research culture, innovation, and community outreach. Harvey (2004) highlights that research productivity and industry-academia collaborations are seen as indicators of institutional maturity. As per Altbach (2005), accreditation acts as a catalyst for institutions to develop research policies, support faculty publications, and engage in knowledge dissemination.

This dimension pertains to the adequacy and accessibility of physical and digital infrastructure, including libraries, laboratories, ICT tools, and support facilities. According to Brennan and Shah (2000), well-developed infrastructure enhances the overall academic environment, enabling institutions to offer quality education and support student learning effectively. Accreditation frameworks assess how institutions facilitate student development through mentoring, career services, financial aid, and extracurricular opportunities. Tinto (1993) argues that strong support systems reduce dropout rates and improve student satisfaction and retention. Institutions with effective progression tracking and alumni engagement perform better on accreditation benchmarks.

Effective leadership and transparent governance structures are considered foundational for institutional success. The NAAC framework (2020) encourages decentralization, participative management, and strategic planning. As per Harvey and Green (1993), institutions with strong internal quality assurance cells and data-driven decision-making processes exhibit sustained improvement. This dimension focuses on inclusivity, sustainability, social responsibility, and ethical practices. Singh & Srivastava (2018) emphasize that embedding institutional values fosters a positive academic culture and enhances institutional identity. Accreditation requires institutions to showcase unique best practices that contribute to societal and educational development.

In summary, the literature supports the notion that the multidimensional accreditation framework enhances the overall quality and accountability of higher education institutions. Each criterion contributes uniquely to building a robust academic ecosystem, and their combined influence drives continuous institutional growth.

3. RESEARCH GAP

While accreditation is widely recognized as a critical tool for assuring quality and promoting continuous improvement in higher education institutions, the empirical investigation into its actual impact on the academic environment remains limited. Most existing studies tend to focus on accreditation outcomes in terms of institutional rankings, compliance metrics, or administrative reforms, rather than examining its influence on core academic dimensions such as teaching-learning practices, faculty engagement, student satisfaction, and research culture. Furthermore, much of the literature is either conceptual or based on data from highly ranked institutions, with little attention paid to state-run or rural institutions where the impact may vary significantly. This creates a clear research gap in understanding how accreditation processes translate into tangible academic improvements across diverse educational contexts. There is a pressing need for evidence-based research that assesses the depth and sustainability of accreditation's influence on the academic ecosystem beyond surface-level compliance.

The present study holds relevance for higher education institutions (HEIs) that are either preparing for accreditation or undergoing the re-accreditation process. It explores the connection between the concept of excellence and the role accreditation plays in achieving it. The paper highlights how accreditation contributes to various institutional goals, including institutional growth through increased admissions and enhanced reputation, improved stakeholder satisfaction, effective strategic planning in areas such as internationalization and employability, as well as strengthening academic standards through improved faculty quality, curriculum design, learning outcomes, and advancements in research and innovation.

4. OBJECTIVE OF THE STUDY

- To assess the impact of each dimension of accreditation on the academic environment.

5. CONCEPTUAL FRAMEWORK

A conceptual framework is a structured plan or model that outlines the key concepts, variables, and their relationships within a research study. It serves as a guiding blueprint, helping researchers logically organize their thoughts, explain the theoretical underpinnings of their study, and connect existing knowledge with the research objectives. By identifying what will be studied and how the variables are expected to interact, the conceptual framework ensures clarity, coherence, and direction throughout the research process.

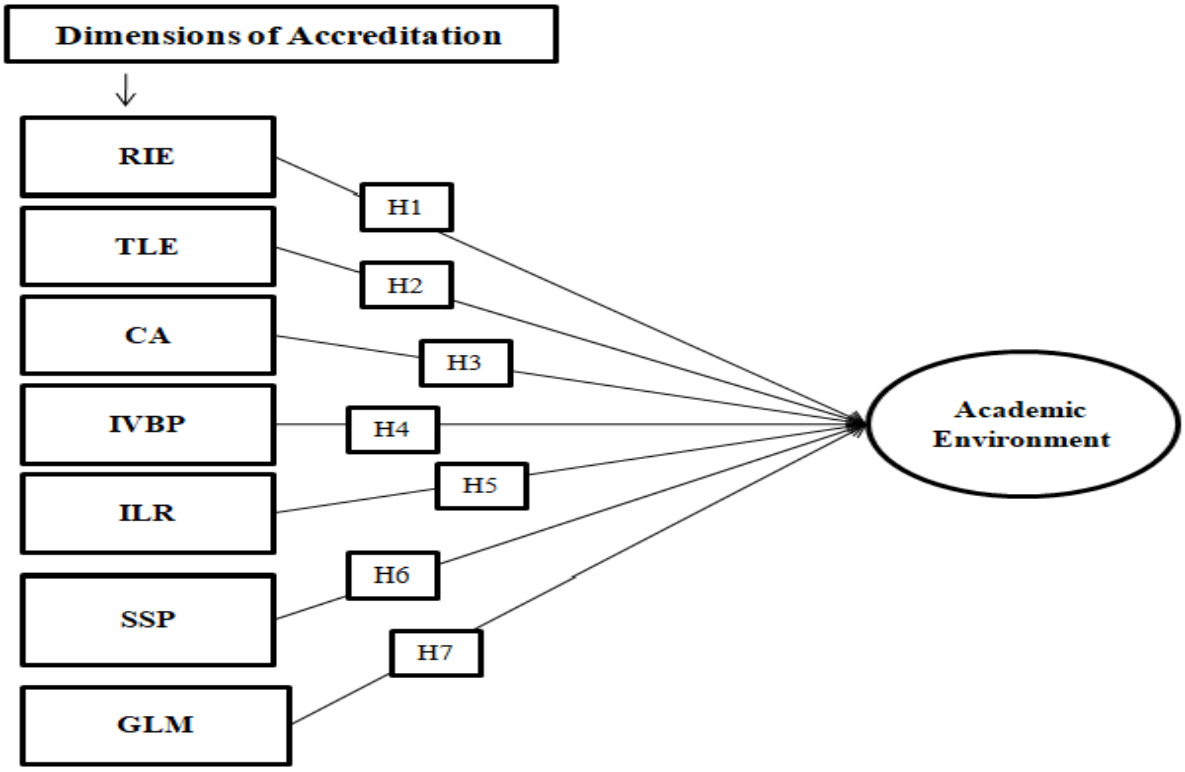

Figure 1: Conceptual Framework

Source: Researcher's compilation

(Here, RIE: Research, Innovation and Extension, TLE: Teaching-Learning and Evaluation, CA: Curricular Aspects, IVBP: Institutional Value and Best Practices, ILR: Infrastructure and Learning Resources, SSP: Student Support and Progression, GLM: Governance, Leadership and Management)

6. HYPOTHESES FORMULATION

$H_1$1: there is a significant impact of RIE on academic environment.
$H_1$2: there is a significant impact of TLE on academic environment.
$H_1$3: there is a significant impact of CA on academic environment.
$H_1$4: there is a significant impact of IVBP on academic environment.
$H_1$5: there is a significant impact of ILR on academic environment.
$H_1$6: there is a significant impact of SSP on academic environment.
$H_1$7: there is a significant impact of GLM on academic environment.

7. RESEARCH METHODOLOGY

This section outlines the methods employed for collecting, analyzing, and interpreting data relevant to the present study. Information was gathered from over 467 faculties enrolled in Higher Education Institutions (HEIs) within the National Capital Tertiary Region (Delhi/NCR) to examine how accreditation influences student admissions. The quantitative component involved structured questionnaires distributed among faculty members and administrators in 10 NAAC-accredited institutions across Haryana. Stratified random sampling was used to ensure representation from different

types of institutions (state universities, private universities, and autonomous colleges). A total of 467 responses were collected.

A structured survey questionnaire was used, incorporating 7 key dimensions of accreditation and 11 key factors of academic environment. The collected data was analyzed using MS Excel, SPSS and SmartPLS software. Additionally, relevant literature and sources from various accrediting, ranking, and regulatory/signatory bodies were reviewed to assess the broader impact on HEIs. Although NAAC and NBA serve as the primary accrediting agencies in India for institutional and program-level assessments respectively, the influence of several other well-recognized accrediting and ranking organizations was also considered in the analysis. To assess the internal consistency of the survey instruments, Cronbach's Alpha test was employed, yielding high reliability score: 0.863 for the faculty survey. The validity of the questionnaires was evaluated using the outer loadings, AVE, HTMT ratio, and fornell-larcker criterion, which fall within the acceptable range of validity. Data was processed using spreadsheet software, and relevant graphical representations were created to support analysis.

Additionally, the study examined the possibility of common method bias (CMB) by employing Harman's single-factor test, a technique recommended by Podsakoff et al. (2003) for addressing CMB concerns. In line with the procedure outlined by Podsakoff and Organ (1986), this test was conducted to detect any potential bias arising from the measurement method. A commonly used technique to detect CMV involves loading all measurement items associated with latent constructs onto a single factor. If this single factor accounts for less than 50% of the total variance, it suggests that CMV is unlikely to significantly impact the study. In the present analysis, the single factor explained 37.027% of the total variance, well below the 50% threshold, indicating that CMV did not significantly affect the outcomes (Podsakoff et al., 2003).

After completing the bias assessment, the researcher moves on to the next stage of the study—hypothesis testing—which is carried out in an objective manner.

8. Analysis and Interpretation of Data

The objective of this research is to find out the impact of dimensions of accreditation on academic environment in higher education institutions. Using a structured questionnaire and responses from 467 professors, associate professors, and assistant professors, the study reveals a significant positive relationship between accreditations and academic environment. To achieve this, the researcher has utilized "Partial Least Squares Structural Equation Modeling (PLS-SEM)". In the fields of social sciences, marketing, and business research, there has been a significant rise in the use of PLS-SEM, as noted by Hair et al. (2019).

All the dimensions of accreditation and academic environment are studies in existing literature, so, the researcher conducted structural equation modeling (SEM) using Smart-PLS to examine how accreditation affects institutions' academic environment.

8.1 Examination of the Measurement Model

The evaluation of the measurement model is conducted through confirmatory factor analysis, which involves assessing the reliability and validity of each construct using the Consistent PLS-SEM algorithm.

Table 1: Reliability and Validity of the Model (Accreditation)

Second order construct	Zero order construct	Items	Items' outer loadings	CA	CR	AVE
Accreditation	RIE	RIE1	0.855	0.941	0.952	0.655
		RIE2	0.858			
		RIE3	0.787			
		RIE4	0.683			

		RIE5	0.734			
		RIE6	0.719			
	TLE	TLE1	0.852	0.874	0.947	0.740
		TLE2	0.879			
		TLE3	0.862			
		TLE4	0.872			
		TLE5	0.820			
		TLE6	0.869			
		TLE7	0.866			
	CA	CA1	0.739	0.762	0.843	0.618
		CA2	0.816			
		CA3	0.779			
		CA4	0.813			
		CA5	0.839			
	IVBP	IVBP1	0.824	0.864	0.903	0.637
		IVBP2	0.808			
		IVBP3	0.663			
		IVBP4	0.674			
		IVBP5	0.842			
		IVBP6	0.804			
		IVBP7	0.831			
	ILR	ILR1	0.816	0.933	0.906	0.750
		ILR2	0.876			
		ILR3	0.868			
		ILR4	0.842			
	SSP	SSP1	0.879	0.892	0.916	0.742
		SSP2	0.881			
		SSP3	0.835			
		SSP4	0.846			
		SSP5	0.885			
		SSP6	0.870			
	GLM	GLM1	0.808	0.857	0.897	0.610
		GLM2	0.854			
		GLM3	0.842			
		GLM4	0.677			
		GLM5	0.693			
		GLM6	0.824			

Source: Researcher's Compilation

Table 2: Reliability and Validity of the Model (Academic Environment)

Second order construct	Zero order construct	Items	Items' outer loadings	CA	CR	AVE
Academic Environment	PEU	PEU1	0.848	0.908	0.929	0.686
		PEU2	0.850			
		PEU3	0.845			
		PEU4	0.812			
		PEU5	0.801			
	FE	FE1	0.848	0.875	0.914	0.726
		FE2	0.875			
		FE3	0.809			
		FE4	0.873			
	FDT	FDT1	0.721	0.760	0.824	0.617
		FDT2	0.956			
		FDT3	0.709			
	MSS	MSS1	0.831	0.816	0.878	0.645
		MSS2	0.736			
		MSS3	0.871			
		MSS4	0.766			
	LU	LU1	0.871	0.763	0.804	0.527
		LU2	0.719			
	CO	CO1	0.815	0.815	0.878	0.529
		CO2	0.775			
	AR	AR1	0.861	0.754	0.793	0.582
		AR2	0.736			
	PW	PW1	0.821	0.816	0.878	0.644
		PW2	0.757			
		PW3	0.818			
	IEP	IEP1	0.884	0.883	0.918	0.737
		IEP2	0.859			
		IEP3	0.815			
		IEP4	0.874			
	SP	SP1	0.843	0.812	0.876	0.640
		SP2	0.740			
	ARI	AR1	0.834	0.816	0.890	0.729

		AR2	0.827			
		AR3	0.900			

Source: Researcher's Compilation

(Here, PEU: Physical Environment of the University, FE: Faculty Expertise, FDT: Faculty Development and Training, MSS: Management and Supporting Staff, LU: Location of University, CO: Course Offered, AR: Academic Results, PW: Placements Work, IEP: Industry Exposure and Placements, SP: Selection Process, ARI: Academic Reputation and Internationalization)

8.1.1 Reliability of the Model

The reliability of each construct was assessed individually through Cronbach's Alpha (CA) and Composite Reliability (CR). As noted by Hair et al. (2010), these are considered cautious yet effective measures of internal consistency. Based on their recommended threshold, a construct is considered reliable if both CA and CR values exceed 0.70. As presented in Table 1 and Table 2, all constructs meet this requirement, confirming the reliability of the measurement items used in the study.

8.1.2 Validity of the Model

8.1.2(a) Convergent Validity: Convergent validity assesses how well a construct represents the concept it is intended to measure by evaluating the correlation between the construct and its associated indicators. To determine convergent validity, it is important to analyze both the factor loadings of individual items and the Average Variance Extracted (AVE) for each construct. According to the guidelines provided by Hair et al. (2019), item loadings should exceed 0.70, and the AVE should be greater than 0.50. As shown in Table 1 and Table 2, all item loadings are above 0.70 and the AVE values for each construct surpass 0.50, thereby confirming satisfactory convergent validity.

8.3 Discriminant Validity

Discriminant validity determines the extent to which a construct is distinct from other constructs within the same model. It verifies that each construct measures a unique concept and is not excessively correlated with others in the framework. Common approaches for assessing discriminant validity include the Fornell-Larcker Criterion and the Heterotrait-Monotrait Ratio (HTMT).

Table 3: Fornell- Larcker Criterion (Accreditation)

Construct	CA	IVBP	ILR	SSP	RIE	GLM	TLE
CA	**0.860**						
IVBP	0.199	**0.786**					
ILR	0.299	0.333	**0.866**				
SSP	0.206	0.632	0.326	**0.728**			
RIE	0.082	0.171	0.113	0.157	**0.798**		
GLM	0.140	0.238	0.210	0.254	0.526	**0.781**	
TLE	0.083	0.144	0.108	0.136	0.531	0.551	**0.809**

Source: Researcher's Compilation

Table 4: Fornell- Larcker Criterion (Academic Environment)

Construct	AR	LU	CO	PEU	FE	FDT	MSS	IEP	PW	SP	AIR
AR	0.694										
LU	0.144	0.726									
CO	0.229	0.53	0.727								
PEU	0.639	0.331	0.552	0.828							
FE	0.203	0.083	0.098	0.061	0.852						
FDT	0.007	-0.011	-0.109	0.001	0.148	0.785					

MSS	0.017	0.02	-0.054	0.018	0.059	0.018	0.803				
IEP	0.086	0.021	0.031	0.104	0.243	0.186	0.009	0.858			
PW	0.273	0.571	0.392	0.547	0.114	0.14	0.063	0.133	0.802		
SP	0.364	0.282	0.199	0.446	0.22	0.046	0.05	0.154	0.318	0.800	
AIR	0.114	0.445	0.407	0.18	0.169	-0.094	-0.081	0.028	0.167	0.253	0.854

Source: Researcher's Compilation

Tables 3 and 4 display the results of the Fornell-Larcker Criterion used to evaluate discriminant validity for the constructs related to accreditation and academic environment, respectively. As per the guideline by Fornell and Larcker (1981), discriminant validity is established when the square root of the Average Variance Extracted (AVE) for each construct (shown on the diagonal) exceeds the corresponding correlations with other constructs (off-diagonal values). This suggests that each construct is more strongly associated with its own indicators than with those of other constructs, thereby supporting the adequacy of discriminant validity within the measurement model.

8.3.1 Hetero trait – Mono trait Ratio (HTMT)

Table 5: HTMT Criterion (Accreditation)

Construct	CA	IVBP	ILR	SSP	RIE	GLM	TLE
CA							
IVBP	0.219						
ILR	0.319	0.364					
SSP	0.250	0.735	0.386				
RIE	0.094	0.198	0.125	0.202			
GLM	0.145	0.256	0.215	0.300	0.590		
TLE	0.090	0.163	0.117	0.173	0.611	0.608	

Source: Extracted from SmartPLS4

Table 5 and 6 display the Heterotrait-Monotrait Ratio (HTMT) values used to assess discriminant validity among the constructs of accreditation and academic environment. According to the HTMT criterion, discriminant validity is established when the HTMT values between any two constructs are below the commonly accepted threshold of 0.85 (Henseler et al., 2015). In these tables, all HTMT values fall well below the 0.85 threshold. This indicates that the constructs are sufficiently distinct from one another, thereby confirming the presence of discriminant validity in the measurement model.

Table 6: HTMT Criterion (Academic Environment)

Construct	AR	LU	CO	PEU	FE	FDT	MSS	IEP	PW	SP	AIR
AR											
LU	0.239										
CO	0.496	0.690									
PEU	0.315	0.436	0.382								
FE	0.388	0.382	0.354	0.068							
FDT	0.228	0.306	0.391	0.061	0.148						
MSS	0.151	0.350	0.217	0.048	0.092	0.049					
IEP	0.310	0.119	0.137	0.117	0.274	0.184	0.073				
PW	0.631	.616	0.078	0.632	0.132	0.185	0.079	0.148			

SP	0.400	0.632	0.689	0.521	0.255	0.078	0.085	0.180	0.384		
AIR	0.395	0.739	0.713	0.202	0.186	0.106	0.093	0.071	0.192	0.311	

Source: Extracted from SmartPLS4

Accreditation and academic environment is treated as second-order construct. Therefore, evaluating its convergent and discriminant validity is not required.

8.4 Evaluation of structural model

The structural model is evaluated to analyze the relationships among constructs and to assess the model's predictive capability. This involves examining path coefficients, the coefficient of determination (R^2), and predictive relevance (Q^2). Table 7 outlines the R^2 and Q^2 values for the construct "Academic Environment" (AE). The R^2 values reflect the extent to which the variance in the dependent variable is accounted for by the independent variables.

Table 7: Coefficient of Determinations

Dependent Variable	R-Square	Q-Square
Academic Environment	.666	.626

Source: Researcher's' Compilation

Table 7 presents the coefficient of determination (R^2) and predictive relevance (Q^2) for the construct academic environment. The R^2 value of 0.666 indicates that approximately 66.6% of the variance in the academic environment is explained by the independent variables (dimensions of accreditation) in the model, reflecting a strong level of explanatory power. These values suggest a moderate level of explanatory power (Cohen, 1988; Singh et al., 2024). Additionally, the Q^2 value of 0.626 demonstrates substantial predictive relevance, suggesting that the model has a good capability to accurately predict the outcomes related to the academic environment construct (Hair et al., 2019). Overall, these findings support the robustness and predictive strength of the structural model.

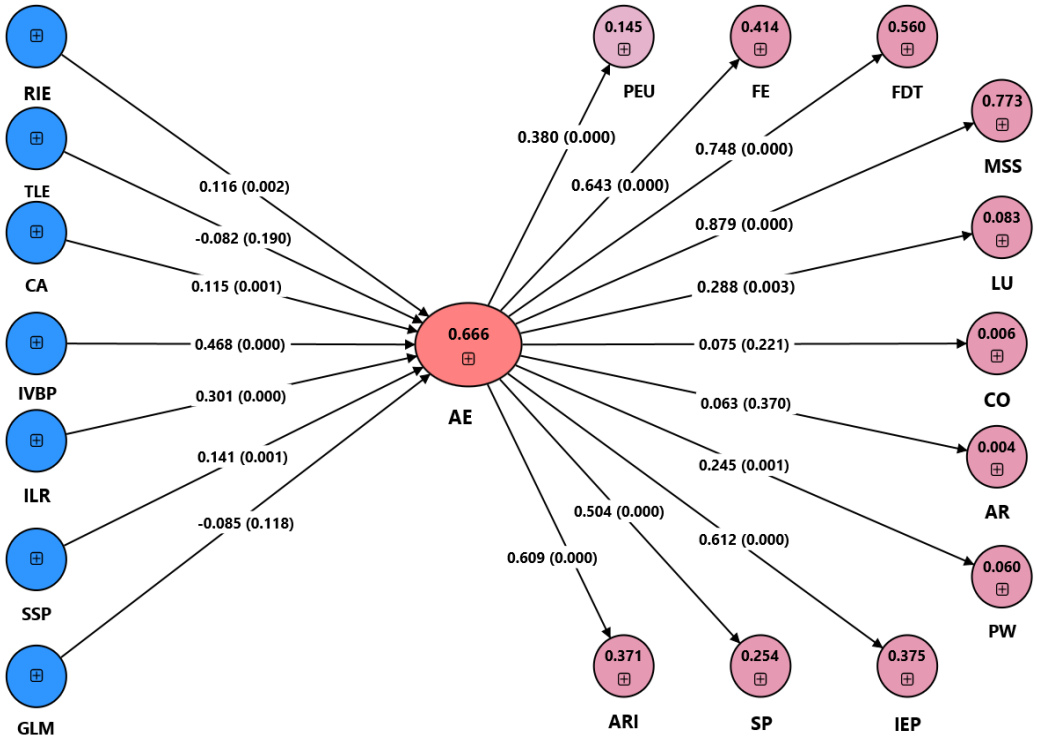

Figure 2: Structural Model Assessment

Source: Computed using Smart-PLS4

Path Coefficients and Hypothesis Testing

Path coefficients represent the magnitude and direction of relationships between constructs. To evaluate their significance, the bootstrapping technique is applied, which generates t-values and p-values. A path coefficient is considered statistically significant if the p-value is less than 0.05, thereby validating the proposed hypotheses and reinforcing the underlying theoretical framework.

Table 8: Hypotheses Remarks

Exogenous & Endogenous Variable	Hypotheses	Path Coefficient	Standard Error	T statstics	P-Value	Remarks
RIE -> AE	H11	.116	.038	3.079	.002	Accepted
TLE -> AE	H12	-.082	.063	1.312	.190	Rejected
CA -> AE	H13	.115	.034	3.366	.001	Accepted
IVBP -> AE	H14	.468	.057	8.245	.000	Accepted
ILR -> AE	H15	.301	.050	6.011	.000	Accepted
SSP -> AE	H16	.141	.044	3.238	.001	Accepted
GLM -> AE	H17	-.085	.053	1.563	.118	Rejected

Source: Researcher's Compilation

Table 8 summarizes the results of the hypothesis testing related to the Academic Environment (AE) construct. The path coefficients, along with their corresponding t-statistics and p-values, reveal the significance of each relationship. The results show that RIE ($H_1$1), CA ($H_1$3), IVBP ($H_1$4), ILR ($H_1$5), and SSP ($H_1$6) have a significant positive influence on AE, as their p-values are below the 0.05 threshold, leading to the acceptance of these hypotheses. Conversely, the paths from TLE ($H_1$2) and GLM ($H_1$7) to AE are not statistically significant, with p-values of 0.190 and 0.118 respectively, resulting in the rejection of these hypotheses. These findings partially support the theoretical framework, indicating that while most variables positively impact the academic environment, a few do not show a significant effect.

9. Importance and Performance Analysis

IPMA is a strategic tool used in PLS-SEM to prioritize improvements by comparing the importance of constructs (how much they impact a target variable like academic environment here) against their performance (how well they're currently doing). The purpose is to identify areas where improvements will have the most significant effect. By mapping these dimensions, managers can focus resources on factors that are highly important but underperforming, while maintaining or deprioritizing high-performing but low-impact areas.

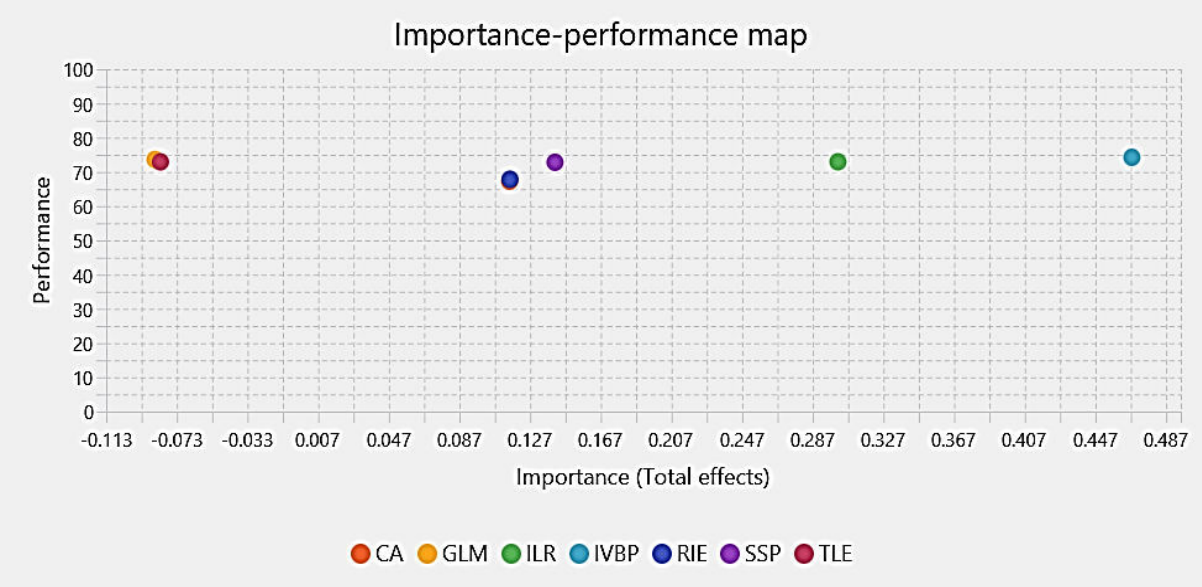

Figure 3: Importance-Performance Map (IPMA)

The Importance-Performance Map (IPMA) visually represents the relative importance (total effects) and performance of various constructs in influencing the Academic Environment (AE). Among all constructs, IVBP stands out with the highest importance (0.48) and strong performance (70), indicating it is both impactful and well-executed. ILR and SSP also demonstrate high importance (0.29 and 0.17, respectively) with commendable performance levels. In contrast, constructs like CA, GLM, and TLE have negative or minimal importance scores and moderate performance, suggesting limited influence on AE and potential areas for strategic improvement. Prioritizing constructs with high importance but lower performance can enhance overall academic environment effectiveness.

10. DISCUSSION

The study aimed to investigate the structural relationships among various institutional factors and their impact on the academic environment within higher education institutions. The integrated analysis illustrates that while most constructs significantly contribute to the academic environment, certain variables like innovative practices, learning resources, and student support are particularly influential. Institutions should prioritize enhancing these high-importance areas while also focusing on improving the strategic relevance of teaching-learning and governance mechanisms to strengthen overall academic quality and institutional excellence. Effective governance was found to significantly correlate with faculty satisfaction and institutional trust. Institutions with decentralized leadership reported higher engagement and policy responsiveness (Altbach, 2005; Singh & Srivastava, 2018). Curriculum relevance and periodic updates, as mandated by NAAC, led to improved learning outcomes and student satisfaction. Integration of skill-based modules was a major driver of employability. Faculty training, research incentives, and appraisal mechanisms fostered professional growth, directly enhancing the academic climate (Stensaker, 2008). Well-equipped laboratories, libraries, and ICT tools significantly impacted student engagement and academic output. Institutions with higher NAAC scores showed better student-teacher ratios and resource availability. Accredited institutions demonstrated better research visibility, collaborative projects, and publication metrics. Institutional support for research contributed to a culture of inquiry and innovation (Harvey, 2004). Mentoring, placement assistance, and grievance redressal mechanisms improved student satisfaction and retention. Practices promoting inclusivity, sustainability, and ethical conduct reinforced a positive and value-driven academic culture.

11. CONCLUSION

The study affirms that the dimensions of accreditation substantially influence the academic environment of HEIs. While governance, faculty development, and infrastructure emerged as strong predictors of academic performance, continuous monitoring and stakeholder involvement are essential for sustained improvement. Accreditation should not merely be a compliance activity but a strategic tool for institutional transformation. This study provides comprehensive insights into the factors influencing the academic environment within higher education institutions, using a robust analytical framework that includes discriminant validity assessment, structural model evaluation, and Importance-Performance Map Analysis (IPMA). The findings confirm that constructs such as Innovative Value-Based Practices, Institutional Learning Resources, and Student Support Practices play a significant role in shaping a positive academic environment, both in terms of statistical significance and practical impact. The high R^2 and Q^2 values indicate strong explanatory and predictive power of the model. However, areas such as Governance and Leadership Mechanisms and the Teaching-Learning Environment showed limited influence, suggesting the need for targeted improvements. Overall, the study underscores the importance of aligning institutional efforts with high-impact areas to enhance the academic environment, thereby supporting quality assurance, accreditation goals, and long-term educational outcomes.

12. RECOMMENDATIONS

- Institutions should establish internal quality assurance cells to maintain accreditation standards.
- Greater autonomy in curriculum development must be granted for context-specific innovation.

- Regular faculty development programs should be mandated.
- Budget allocations must prioritize research and infrastructure development.

13. LIMITATIONS

While this study offers valuable insights into the factors influencing the academic environment in higher education institutions, several limitations must be acknowledged. First, the research is based on cross-sectional data, which restricts the ability to infer causal relationships over time. Longitudinal studies would provide a more dynamic understanding of how institutional factors evolve and impact the academic environment. Second, the data were collected from a specific geographical and institutional context, which may limit the generalizability of the findings to other regions or educational settings. Third, although the study employed robust statistical techniques, it focused primarily on quantitative measures, potentially overlooking qualitative dimensions such as faculty perceptions, cultural influences, or institutional policies that may also shape the academic environment.

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SOFT SKILLS FOR SUSTAINABLE FUTURES: EXAMINING THE ROLE OF LITERATURE IN SOCIAL INNOVATION AND INCLUSIVE GROWTH

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ABSTRACT: ***Human beings have been considered as the wisest species on the planet. The human civilization reached its peak with the discovery of language, living in social groups, developing common living standards and societal harmony. And hence it is evident that humans need social living, cultural coherence and harmony. Aristotle has rightly said, 'Human is a social and political animal.' Hence, social innovation and inclusive growth cannot take l place without having the proper understanding of the core-needs of the society. Thus, in understanding of the core needs of the society, the role of literature is significant. As it is said that 'literature is the criticism of life' and human life is about living in harmony, believing in prosperity for all. Hence, literature can become the efficient, effective and crucial tools to achieve sustainable futures, social innovation and inclusive growth. Moreover, the paper tries to highlight the role of soft skills as a part of literature in understanding the importance of sustainable future by achieving social innovation and Inclusive growth. The paper uses demonstrative, analytical and critical approach. The paper also addresses the gaps between soft skills in aligned with literature and considering that the subjects are not separate entities to depart the global issues in specific domains. Hence to make this life or the planet more sustainable, inclusive and innovative for all, it is essential to understand the core parameters of the society with the help of Soft Skills and Literature.***

KEYWORDS: ***Soft Skills, Sustainable Development Growth, Social Innovation and Inclusive Growth, Communication Skills***

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1. INTRODUCTION

The human life and tradition is need-based as with needs, human beings have changed their course of actions. Need became the powerful tool to adapt to the situations and hence with evolving time human beings have changed themselves rapidly. As human discovered the language, the medium of writing has flourished, and from tradition to writing artistic literary works have evolved. In Contemporary world, digital communication has connected the world together into a single entity.

Hence rapidly changing world has demanded the employability skills in almost all the professions and domain. Along with technical skills certain other skills were also required to perform well in the career to achieve growth. As human is a very dynamic species and hence continuous learning is the hallmarking feature of human existence. Thus, to achieve sustainability in the life one requires awareness and critical thinking, decision making abilities and communication skills.

As in contemporary world the sustainable future is crucial across the global boundaries and the generations to come. The world after globalization has become more connected hence the need of skills become the urgency of the time. Since the ages, the history has witnessed the progressive civilizations which had standardized sets of values, accepted behavior as their standards of living such as Indus valley civilization marked the social coexistence without any prominent religious hallmark shows its secular features of that point of time.

Thus for the continuity of human civilization, social harmony and with progress certain accepted standards are nowadays crucial to make sustainable future. Hence the role of literature and soft skills for greater and conceptual understanding for the sustainable future is crucial. As literature provides real life based or fictional glimpse of human nature and the behavior through which human can learn the accepted behavior distinctly.

2. ROLE OF LITERATURE IN SOCIAL INNOVATION AND INCLUSIVE GROWTH

Human life is dynamic, magnificent and diverse. What a human has experienced and can imagine will become the literature in the future. As it is said that literature is the criticism of life and life is the journey of human where essence is lies in the human heart, mind and in action. Literature depicts the reality of life or society and explores imaginative aspects of human mind in other word the former called as non-fictional literature and later known as fictional literature. Literature can be in the oral form or in the written form. It can be explored in various genres such as poetry, drama, novel, short story etc. Role of literature in the sustainable future can be depicted understood ways

- At present for climate change the global agencies such as UNESCO and UN environment, people promoted literature and literary lines as a tools for environmental consciousness, especially on World Environment Day etc.
- UN platforms have published poems and literary reflections related to climate change as a moral and cultural crisis not just a scientific one.
- World Wide Fund for Nature (WWF) frequently used and adapted literary lines, parables and emotionally charged storytelling, it also prefers to use metaphor rich language to connect people rather technical or mechanical one.
- Use of eco-poetry, narratives by world organizations shows the role of literature in increasing the awareness.
- Use of slogans and quotes for social awareness and raising issues, role of literature is significant.
- To society more coherent and sustainable, literature can guide the human actions.

Hence literature is the artistic expression of human life. It can be understood in the following ways:

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Literature	Social Innovation and Inclusive Growth	Impact
Poetry	Heals human in life, gives courage	Poetry, Ghazal online Programs
Novels	Make individual aware about situations, inspires to take initiatives, gives courage to follow less discovered paths	Real life based movies
Drama	Shows reality or serious issues of society and increases awareness	Street plays, poster presentation
Letters	Precise medium of communication	Standardization of language and formats
Short Stories	Popular form, heal people and refreshes them	Short clips on social awareness issues

Figure 1: Impact of Literature on Social Innovation and Inclusive Growth

Hence the role of literature in sustainable living is essential. As literature brings morality into actions, it widens the role of human and their moral encompass. Literature can become the moral voice for raising 21st century's issues and challenges. Even the guiding pillars of human rationality i.e. Sustainable Development Goals (SDGs) also cherish the literary aspects such as

- SDG 4 explicitly promotes quality *Education* which asserts reading, critical thinking and literacy on the other hand it also encourages cultural texts, humanities and language learning as well. It also supports access to books and improvement in knowledge system.
- As the Target 4.6 and 4.7 of SDG 4 ensures reading and promotion of literature and ensure learners acquire knowledge which leads to sustainable development which explicitly allows and encourages literature, storytelling, eco-literature and cultural narratives.
- SDG 5 which is about *Gender Equality*, which has directly gave the voice and legitimate relevance to literary world by expanding women's writing, feminist literature and representation.
- SDG 11 mentions *Sustainable Cities and Communities*. It enables to preserve the cultural heritage which works as an inspiration for literature generation.
- Implicitly SDG 13 mentioned *Climate Actions* which also shows the relevance of literature where narratives and storytelling explicitly used (also acknowledged by UNESCO and UN).
- SDG 16 talks about *Peace, Justice And Strong Institutions*, for the sustenance of these abstract values literature can become guiding encompass as past teaches what not to repeat hence rich literary tradition helps to bring values in action. It also promotes dialogue, ethics and empathy.
- SDG 10 talks about *Reduced Inequalities*, which also gives voice to marginalized communities, postcolonial literature, storytelling and folk literature.

Thus it is evident that literature is the artistic form of powerful expression used widely by various organizations and group of people to sensitize humanity, to generate common consensus make the life and future sustainable.

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3. SOFT SKILLS FOR SUSTAINABLE FUTURES

The contemporary world with rapid changes in the technology has given the signal to the world's workforce to enhance skills to meet the global demands. Hence the role of literature is wider to enhance the qualities in real life such as communication skills, personality development skills, and empathy etc., here come the role of soft skills. According to the Oxford Advanced Learners Dictionary, soft skills are personal abilities and traits. Soft skills are the personal qualities reflected in the individual behavior. Soft skills are non-technical in nature they are cognitive aspects of human mind.

Soft skills refine the personality and enhance the human behavior. There are dozens of soft skills such as communication skills, personality development, emotional intelligence, stress management skills, leadership skills, empathy, decision making and critical thinking etc. Soft skills are the building blocks of human behavior in the society. The soft skills help in understanding the literary view better as through the literature one can understand

- The society well and the values society accepts and cherishes.
- Through literature visual memory expands and helps to reflect in a better way
- Through the dialogues, poetic lines, and situations of the characters one can understand the skills well.

Hence the role of literature is like a laboratory and a cultural classroom. Hence it is rightly said that literature is the mirror of the society. And soft skills are the flowers blooming on the land of literature. The role of soft skills for sustainable can be understood in the following manner.

- Soft skill such as communication skills is one of the key skills. In communication the internal aspects can understood well. Communication as one of the key soft skills include intrapersonal communication and interpersonal communication in which the former is the communication with oneself and the later is related to engaging with others. Communication helps to deal with the situation effectively and reduces the chances of miscommunication. The world at present requires effective strategies and initiatives to start the communication and resolve the issues. Such as neighbor country's majority of the problems will resolve with effective and proper communication channel. Thus to make the world more inclusive and healthy human actions for all, proper communication as a soft skills is required.
- Emotional intelligence (EI) is one of the key soft skills. EI is required to make the lives more meaningful and effective. EI helps to understand the situation well. It helps to build the balanced life. Emotional intelligence required the deeper understanding of the situation well. It also required to have control over the emotions. EI is simply means an individual having the capacity to cope up with any situation effectively and efficiently. Hence EI is crucial to balance the situation and turn the surrounding into a sustainable future.
- Leadership skill is core aspect of human existence. In all the walks of life almost all the individuals have to take the decision and manage their life. Hence leadership skill provides the ground to take the responsibility of the human life. Leader guides the actions and brings changes into the course of action. In sustainable future belongs to healthy, and vision oriented leaders.

Thus soft skills can become the essential tool to improve the individual behavior and also to make the sustainable future. Even the literature works as a laboratory where soft skills can be easily nurtured. In the following ways one can understand the relation of soft skills, with literature and its effects on sustainable futures.

Hence it can be said that soft skills are essential for future growth. Soft skills are the basic pillars of individual growth. Soft skills crucial for letting the individuals understand their role in the society. Soft skills have greater explicit and implicit impact on the human behavior and actions.

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Soft Skills	Literature	Sustainable Futures
Leadership Skills	Samidha by Sadhana Tai Amte	Show leadership skills, how take initiatives for common cause e.g., they built hospitals for poor, taken care of leprosy patients
Communication Skills	Pride and Prejudice by Jane Austen	Shows how miscommunication cause social disharmony among family relations and confusions
Personality Development Skills	The Beggar by Anton Chekov	The character of Sergei and Olga has influenced many as emotional attachment changes people
Teamwork	Samidha by Sadhana Tai Amte	A social work started by the couple at early hand later bloomed into the garden of services, many people joined later their projects
Stress Management Skills	Final Solutions by Mahesh Dattani	Stressful situation
Emotional Intelligence Skills	My Financial Career by Stephen Leacock	One relate the importance of control over emotions in public life and confidence building

Figure 2: Role of Soft Skills w.r.t. literature and Sustainable Future

Soft Skills	
Explicit Role of Soft Skills	**Implicit Role of Soft Skills**
i. Change in behavior	i. Change in the character
ii. Understanding of individual behavior	ii. Greater understanding of society
iii. Works at individual level	iii. Shapes in the society
iv. Cognitive process involved	iv. Social conditioning shapes future
v. Experience shapes personality	v. Shapes Experience and learning

Figure 3: Explicit and Implicit Role of Soft Skills

4. CONCLUSIONS

Soft skills are crucial to shape future actions and can make the life more sustainable. As soft skills are the basic abilities of the individual to make the personal growth. Literature is at the center in understanding the role of soft skills and its effects. Thus to make life more inclusive and sustainable the role of literature and its relation with soft skills is significant. As via the understanding of literature and soft skills one can make future inclusive with growth prospects such as:

- Soft skills help in individual awareness which ultimately leads in understanding of others as well.
- Through soft skills one can understand the needs of others which make human mind more sensitive for others and inclusive in the future.
- Through soft skills one can understand the emotional needs of other
- In critical thinking and decision making soft skills play a vital role hence in future it leads to sustainable decision making
- Ethical and moral reasoning leads to rational decision making
- Leadership skills help to take the actions responsibly and make the work more prosperous
- Empathy leads to understand the pain of others which lead to inclusive actions.

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Thus soft skills have wider scope and role to play to make future actions more inclusive and sustainable. Hence in understanding the role of soft skills one has to understand the wider impact soft skills have on actions and also on the future. On the other hand literature has also a role to play in social inclusivity and innovation-driven growth.

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INTEGRATING AI TOOLS IN TEACHING & LEARNING

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ABSTRACT: ***Integrating AI tools in Teaching & Learning enables personalized education, enhances student engagement, and supports educators in both instructional and administrative tasks. This paper examines the role of AI in teaching & learning process and highlights commonly used AI tools with relevant examples. Tools such as intelligent tutoring systems (ALEKS, Carnegie Learning), adaptive learning platforms (DreamBox, Coursera), AI-powered learning management systems (Moodle with AI plugins), automated assessment tools (Gradescope, Turnitin), educational chatbots (ChatGPT, IBM Watson Assistant), and learning analytics tools (Power BI, Tableau with AI features) are discussed. These tools assist in personalized content delivery, instant feedback, performance monitoring, and data-driven academic decision-making. The paper also explores how AI tools promote inclusive education through speech-to-text, text-to-speech, and recommendation systems that address diverse learner needs. Despite the advantages, challenges such as data privacy, ethical issues, digital divide, and the need for faculty training remain significant. The study concludes that the effective and responsible integration of AI tools can significantly improve the quality, accessibility, and efficiency of the education system.***

KEYWORDS: ***Artificial Intelligence, Education, Learning, Teaching, Tools***

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1. INTRODUCTION

Education systems worldwide are transitioning from traditional teacher-centered approaches to learner-centered and technology-enhanced models. AI tools support this transition by enabling adaptive content delivery, continuous assessment, and data-driven instructional decisions. Unlike conventional educational technologies, AI systems get input from user data, process it and dynamically respond to learner behavior.

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2. AI TOOLS IN EDUCATION

Adaptive learning systems are AI-based tools that adjust instructional content, learning pace, and difficulty levels according to individual student performance and learning behavior, enabling personalized learning experiences. It is designed to simulate 1:1 human education by providing step-by-step guidance, identifying learner misconceptions, and offering customized feedback to improve understanding. Automated assessment and grading tools use artificial intelligence to evaluate student work, including quizzes, assignments, and essays, and provide immediate feedback, thereby reducing teachers' workload and enhancing assessment efficiency. Conversational AI tools, such as chatbots and virtual assistants, support learners by answering academic queries, guiding course navigation, and offering learning assistance anytime, which increases learner engagement and accessibility. **The** classification is given in table 1.

Table 1: Classification of AI Tools in Teaching & Learning

Types	**Description**	**Example Applications**	**Educational Level**
Adaptive Learning Systems	Adjust content based on learner performance	Personalized math modules	K–12, Higher Ed
Intelligent Tutoring Systems	Simulate human tutoring	Step-by-step problem solving	STEM Education
Automated Assessment Tools	Grade and provide feedback	Essay scoring, quizzes	All Levels
Conversational AI (Chatbots)	Provide instant learner support	Virtual teaching assistants	Online Learning
Learning Analytics Systems	Analyze learner data	Dropout prediction	Higher Ed

3. BRIEF DESCRIPTION OF AI TOOLS

- Intelligent Tutoring Systems:
  Intelligent tutoring systems viz. ALEKS & Carnegie Learning deliver tailored education by assessing a student's knowledge level, detecting gaps, and offering tailored practice and feedback to help learners master specific subjects such as mathematics.
- Adaptive Learning Platforms
  AI algorithms are used by adaptive learning platforms like DreamBox and Coursera to modify the pace and substance of lessons according on a student's performance, guaranteeing that students receive the right amount of assistance.
- AI-Powered Learning Management Systems
  AI-powered LMS like Moodle, enhanced with AI plugins, help educators manage courses more efficiently by automating administrative tasks, recommending learning resources, and providing insights into student performance.
- Automated Assessment Tools
  Automated assessment tools such as Gradescope and Turnitin enable teachers to grade assignments quickly and consistently, while also providing plagiarism detection and feedback features that support academic integrity and learning improvement.
- Educational Chatbots
  Educational chatbots like ChatGPT and IBM Watson Assistant offer instant academic support by answering student queries, assisting with homework, and providing explanations, which increases student engagement and supports learning outside the classroom.
- Learning Analytics Tools
  Learning analytics tools such as Power BI and Tableau, equipped with AI features, analyze large sets of student data to generate visual reports and predictive insights.

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4. APPLICATIONS OF AI IN TEACHING AND LEARNING

- Personalized Learning: AI systems examine pupil behavior, performance trends, and preferences to tailor instruction. This ensures that advanced learners are challenged while struggling students receive targeted support.
- Assessment and Feedback: AI-driven assessment tools provide instant feedback which makes students to correct bugs and enhance their learning outcomes.
- *Student Support and Engagement: AI chatbots offer 24/7 academic assistance, reducing response time and supporting learner autonomy.* Figure 1 show that AI systems collect and analyze student data from learning activities, such as performance and behavior, and then use this information to adjust the learning content and provide personalized feedback. This continuous process helps create a customized learning experience that supports students' individual needs and improves learning outcomes over time.

Student Interaction
↓
Data Collection (Performance, Behavior)
↓
AI Analysis (Patterns & Needs)
↓
Personalized Content & Feedback
↓
Improved Learning Outcomes

Figure 1: AI-Driven Personalized Learning Cycle

5. BENEFITS OF AI INTEGRATION

By tailoring educational resources as per skills of students, learning style, and speed, artificial intelligence in education allows for personalized learning. By automating repetitive processes like grading, attendance monitoring, and report writing, artificial intelligence (AI) solutions improve teaching efficiency and free up teachers to concentrate more on lesson planning and student engagement. Immediate and continuous feedback provided by AI-powered systems helps students identify learning gaps, correct mistakes, and improve academic performance in a timely manner. AI-driven learning analytics support data-informed decision-making by helping educators monitor student progress, predict learning difficulties, and design targeted interventions. The use of AI tools increases student engagement through interactive learning environments, adaptive challenges, and intelligent tutoring systems that motivate learners to participate actively. Educational institutions benefit from AI by improving resource management, enhancing student retention, and optimizing academic planning through predictive analytics. Overall, the integration of AI in teaching and learning improves educational quality, accessibility, and effectiveness while complementing the role of human educators. Table 2 depicts benefits of AI in teaching and learning.

Table 2: Benefits of AI

Stakeholder	Benefit	Explanation
Students	Personalized learning	Tailored pace and content
Teachers	Reduced workload	Automated grading and reports
Institutions	Data-driven decisions	Improved retention and performance
Society	Inclusive education	Support for diverse learners

6. CHALLENGES AND ETHICAL CONCERNS

AI integration in education system poses certain threats like data privacy, bias, and unequal access. AI systems often require huge data, which raises concerns about how information is collected, stored, and used, potentially threatening student privacy and security. Algorithmic bias can lead to unfair outcomes,

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especially for marginalized groups, if AI tools are trained on unrepresentative data. Additionally, unequal access to technology and internet connectivity can deepen the digital divide, preventing many students from benefiting from AI-enabled learning.

(i) Ethical Issues

AI systems rely heavily on data, raising concerns about:

- Student privacy
- Algorithmic bias
- Transparency in decision-making

(ii) Teacher and Student Readiness

Lack of AI literacy among educators can limit effective implementation. Figure 2 highlights the main challenges that affect AI adoption in education, including ethical concerns, the digital divide, teacher readiness, and infrastructure limitations. Ethical issues such as data privacy, transparency, and algorithmic bias can undermine trust and fairness in AI systems. The digital divide limits access to devices and internet connectivity, preventing many students from benefiting from AI-based learning. Additionally, teachers often lack the necessary training and confidence to use AI tools effectively, which can hinder proper implementation. Finally, inadequate infrastructure, such as outdated hardware and limited technical support, further reduces the reliability and sustainability of AI integration. Addressing these challenges requires policy support, investment, and ongoing professional development.

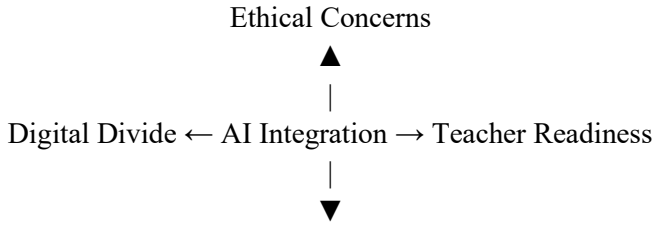

Figure 2: Challenges in AI Integration

The primary obstacles to integrating AI in education are listed in Table 3, including dangers to data privacy, unequal access to technology, low teacher preparedness, and possible algorithmic bias. Furthermore, it recommends mitigating techniques such as robust data protection regulations, infrastructure investment, continuing professional development of teacher, and frequent ethical audits to guarantee equity and openness.

Table 3: Challenges and Mitigation Strategies

Challenge	Impact	Mitigation Strategy
Data Privacy	Risk of data misuse	Strong data governance policies
Digital Divide	Inequality in access	Infrastructure investment
Teacher Resistance	Low adoption	Continuous professional training
Bias in AI	Unfair outcomes	Ethical AI design and audits

7. FRAMEWORK FOR EFFECTIVE AI INTEGRATION

An effective framework for integrating AI in education involves aligning AI tools with teaching objectives, establishing clear ethical policies to protect student data, and providing continuous professional development for teachers. It also requires selecting appropriate AI tools based on curriculum needs and infrastructure, ensuring equitable access for all learners, and conducting ongoing evaluation to measure effectiveness. Collaboration among educators, administrators, and technology developers is essential to ensure AI enhances learning while supporting, rather than replacing, human teaching. This framework emphasizes that AI adoption must begin with policy and pedagogy**,** not technology alone. This is depicted in figure 3.

Policy & Ethics
↓
Teacher Training
↓
Pedagogical Alignment
↓
AI Tool Selection
↓
Evaluation & Continuous Improvement

Figure 3: Pedagogical AI Integration Framework

8. Case Study Examples

1) **Case Study 1: AI in Mathematics Learning**

Students using adaptive AI platforms demonstrated:

- Improved test scores
- Higher engagement levels
- Reduced learning gaps

2) **Case Study 2: AI Chatbots in Online Universities**

AI-based virtual assistants handled the following resulting in increased student satisfaction and retention.

- Academic queries
- Assignment reminders
- Course navigation

9. Conclusion and Future Scope

AI integration in teaching and learning offers immense potential to transform education by enabling personalization, efficiency, and inclusivity. However, its success depends on ethical implementation, teacher preparedness, and equitable access. Institutions must adopt AI as a pedagogical partner, not a replacement for human educators. Future trends in AI and education are expected to focus on more advanced personalization through generative AI, which will create customized learning materials, quizzes, and lesson plans. Emotion AI and adaptive learning systems will enhance engagement by responding to students' feelings and learning needs in real time. Multimodal AI, combining text, voice, and visuals, will support immersive and interactive learning experiences. Additionally, AI-driven mentors and career guidance systems will provide long-term support for students, helping them plan academic paths and future careers. Overall, these advancements will make education more flexible, inclusive, and tailored to individual learners. Table 4 depicts emerging AI trends.

Table 4: Emerging AI Trends

Trend	Description	Expected Impact
Generative AI	AI creating content	Lesson planning support
Emotion AI	Detect learner emotions	Better engagement
Multimodal AI	Text, voice, vision	Immersive learning
AI Mentors	Long-term learner guidance	Career and academic planning

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GREEN FINTECH AND SUSTAINABLE FINANCE: BRIDGING THE GAP BETWEEN DIGITALIZATION AND SUSTAINABILITY

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ABSTRACT: ***Financial technology (FinTech) has grown rapidly in India. It has improved access to banking and digital payments. Financial inclusion is the primary topic of most studies. FinTech's contribution to sustainability has not received much attention. The importance of Green FinTech in advancing sustainable finance in India is examined in this study. The study is based on secondary sources. These include research articles, government reports, RBI publications, and documents from international agencies. The review analyses how digital financial platforms support green investments, sustainable lending, and climate-related financial initiatives. It also examines existing studies and policies to understand how FinTech aligns with India's sustainability goals. The findings show that the adoption of Green FinTech in India remains limited. Major challenges include regulatory gaps, low awareness, data security concerns, and the lack of clear green finance standards. The paper concludes that stronger policy support is needed. Sustainability goals must be better integrated into India's FinTech ecosystem. This is essential for long-term economic and environmental sustainability.***

KEYWORDS: ***Green FinTech; Sustainable Finance; Digitalization; India; Sustainability***

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1. INTRODUCTION

A global financial system is going through fundamental change caused by rapid advancements in digital technology. FinTech, or financial technology, is a broad term that includes various digital developments such as peer-to-peer financing, bitcoin, online payments, mobile banking, artificial intelligence, and data analytics. These innovations have reshaped traditional financial services by enhancing efficiency, accessibility, and transparency. In India, FinTech has emerged as a critical pillar of financial sector development, supported by large-scale digital projects like Digital India, Aadhaar-based identity, Unified Payments Interface, and the expansion of mobile internet connectivity.

At the same time, the global economy faces key environmental issues such as depleted resources, biodiversity loss, and climate change. These issues involve significant risks to economic stability and financial systems. As a result, there has been growing recognition of the need for sustainable finance, which integrates environmental, social, and governance (ESG) considerations into financial decision-making. Sustainable finance aims to mobilize capital toward activities that support long-term environmental protection, social inclusion, and economic resilience. The intersection of digital finance and sustainability has given rise to the concept of Green FinTech. Green FinTech refers to the application of FinTech innovations that support environmentally sustainable financial practices, including green investments, sustainable lending, climate risk assessment, carbon footprint measurement, and ESG reporting. By leveraging digital technologies, Green FinTech can enhance transparency and provide easier access to green financing, which promote the efficient allocation of capital toward sustainable projects.

Despite India's strong FinTech ecosystem and increasing commitment to sustainability through national and international initiatives, the integration of FinTech with green finance remains at a nascent stage. Most FinTech innovations in India continue to focus on payments, credit delivery, and wealth management, with limited emphasis on environmental consequences. This paper aims to bridge this gap by examining the role of Green FinTech in promoting sustainable finance in India. The study reviews existing literature and policy frameworks, and explores the importance of digital financial technologies in supporting sustainability goals. It also highlights key challenges and outlines future opportunities for the growth of Green FinTech in India.

2. REVIEW OF LITERATURE

(i) Evolution of FinTech and Digital Financial Ecosystems

Arner, Barberis, and Buckley (2019),*"The Evolution of FinTech: A New Post-Crisis Paradigm"*, explain that FinTech emerged as a response to regulatory, technological, and trust gaps exposed by the global financial crisis. The authors highlight that FinTech improves transparency, efficiency, and accessibility in financial systems. Although the study does not explicitly focus on sustainability, it establishes a foundation for understanding how digital finance can support broader economic and social objectives.

Lee, I., & Shin, Y. J. (2018),*"FinTech: Ecosystem, Business Models, Investment Decisions, and Challenges"*, conceptualize FinTech as an ecosystem involving start-ups, financial institutions, regulators, and consumers. Their work highlights the transformative impact of digital platforms on financial services while acknowledging challenges related to regulation, cybersecurity, and long-term sustainability. This study highlights the importance of linking FinTech advancements with objectives for inclusive and sustainable development.

Gomber, Koch, and Siering (2019),*"Digital Finance and FinTech: Current Research and Future Research Directions"*, review existing FinTech literature and identify sustainability and green finance as emerging research areas. They emphasize the need for future studies to explore how digital finance can contribute to environmental and social sustainability beyond operational efficiency.

(ii) Digitalisation and the links to Sustainable Finance

Ketterer and Andrade (2020)*"Digitalization and Sustainable Finance: Opportunities and Risks"*. The authors argue that digital platforms reduce information asymmetry, enhance monitoring of green investments, and improve access to sustainable financial products. However, they also caution that inadequate regulation and technological risks may hinder the effective adoption of digital sustainable finance.

Scholtens (2020), in *"Why Finance Should Care About Ecology"*, stresses that financial systems play a crucial role in addressing ecological challenges. The study argues that sustainability should be a core concern of financial decision-making and highlights the potential of digital finance in supporting environmentally responsible investments.

(iii) ESG Investing and Digital Financial Innovations

Boffo and Patalano (2020), in the OECD report *"ESG Investing: Practices, Progress and Challenges"*, analyse global ESG investment trends and identify challenges such as lack of standardisation and data reliability. The report suggests that digital financial tools can enhance ESG transparency and data management, thereby strengthening sustainable investment practices.

The OECD (2023),*"ESG Investing and Digital Finance"*, further emphasizes that digital platforms enable real-time ESG data analysis, improve investor confidence, and support the scaling up of sustainable finance initiatives. The report highlights digital finance as a critical enabler of responsible investment.

(iv) Role of Emerging Technologies in Green Finance

Zhang, Wang, and Liu (2022), *"Blockchain Technology and Green Finance"*, examine how blockchain improve transparency, traceability, and accountability in green financial instruments like green bonds and carbon markets. Their findings suggest that blockchain-based financial systems reduce greenwashing risks and improve trust in sustainable finance mechanisms.

(v) Climate Risk, Financial Stability, and Digital Finance

The Bank for International Settlements (2021), in *"Climate-Related Risk Drivers and Their Transmission Channels"*, explains how climate risks impact financial stability through credit, market, and operational channels. The report highlights the importance of digital risk assessment tools in managing climate-related financial risks.

International Monetary Fund, Monetary and Capital Markets Department (2022), "*Global Financial Stability Report, October 2022: Navigating the High-Inflation Environment"*, identifies climate change as a significant threat to global financial systems. The report emphasizes the increasing role of digital finance in climate stress testing, risk modelling, and sustainable investment assessment.

(vi) Green Finance and Sustainability in the Indian Context

Nenavath and Mishra (2023), in *"Green Finance and Economic Growth in India: Evidence from Sustainable Investment Indicators"*, provide empirical evidence that green finance positively contributes to India's economic growth. The study highlights that digital financial infrastructure strengthens the effectiveness of green finance by improving access and efficiency.

The Reserve Bank of India (2021), in its "*Report on Trend and Progress of Banking in India"*, documents significant growth in digital banking and payment systems but notes limited integration of sustainability considerations.

(vii) Role of International Institutions in Promoting Green FinTech

The World Bank (2021), in *"Green Finance and FinTech: Opportunities for Emerging Economies"*, argues that FinTech can accelerate green finance adoption by reducing transaction costs and enhancing financial inclusion.

The World Bank (2024), in *"Digital Financial Services and Climate Resilience"*, extends this argument by highlighting how digital finance supports climate adaptation and resilience in emerging economies.

UNEP Finance Initiative (2021), in *"Sustainability and Digital Finance"*, emphasizes that digital innovation is essential for aligning global financial systems with sustainability and climate goals.

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3. OBJECTIVES OF THE STUDY

(i) To explore how Green FinTech supports sustainable finance practices in India.
(ii) To review existing studies and government policies to understand how FinTech supports India's sustainability and climate goals.
(iii) To identify the major challenges affecting the adoption and growth of Green FinTech in India.

4. RESEARCH METHODOLOGY

- This study uses a descriptive and analytical research design based on secondary data. •
- Data came from peer-reviewed journals, government and RBI reports, policy documents, and publications from international organizations.

5. DISCUSSION

5.1 Conceptual Framework of Green FinTech

Green FinTech combines digital financial innovation with sustainability goals. It includes various digital solutions that encourage environmentally responsible financial practices and support sustainable economic activities. Key components of Green FinTech include digital platforms for green investments, FinTech-enabled sustainable lending, ESG data analytics, carbon footprint tracking tools, and blockchain-based transparency mechanisms. Sustainable finance, on the other hand, focuses on directing financial resources toward activities that generate long-term environmental and social benefits while maintaining financial viability. By integrating FinTech innovations into sustainable finance practices, Green FinTech enhances efficiency, reduces information asymmetry, and improves access to green financial products. In the Indian context, Green FinTech initiatives are gradually emerging in sectors like renewable energy financing, green bonds, paperless banking, and ESG-focused investment platforms.

5.2 Impact of Green FinTech on Advancing Sustainable Finance in India

Green FinTech is essential for directing financial resources towards projects that promote environmental sustainability. Digital platforms facilitate effective fundraising for projects focused on renewable energy, clean transportation, and sustainable infrastructure. FinTech-based lending platforms enable small and medium enterprises engaged in green activities to access credit more easily. Blockchain technology improves accountability and transparency in green bond issuance and impact reporting. This reduces the risk of greenwashing. Digital payment systems and paperless banking help the environment by reducing paper use and cutting down on carbon emissions from physical transactions.

5.3 Policy Initiatives and Regulatory Environment in India

The Indian government and regulatory authorities have introduced several initiatives to promote digital finance and sustainability. Programs such as Digital India, the National Action Plan on Climate Change, and India's obligations under the Paris Agreements reflect the country's focus on sustainable development. The Reserve Bank of India has acknowledged the importance of climate-related financial risks and has initiated discussions on sustainable finance and climate risk management. Despite these efforts, specific regulatory frameworks for Green FinTech are still evolving. The absence of standardized definitions, reporting norms, and incentives for green finance creates uncertainty for FinTech firms and investors. Enhancing collaboration among regulators, policymakers, and industry participants is crucial for fostering the development of Green FinTech in India.

5.4 Challenges in the Adoption of Green FinTech in India

India faces several challenges in adopting Green Fintech. Regulatory ambiguity and the lack of clear green finance standards hinder innovation and investment. Low awareness among consumers and financial institutions limits demand for green financial products. Data security and privacy concerns

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reduce trust in digital platforms. Additionally, limited availability of reliable ESG and environmental data affects accurate assessment and reporting. Digital infrastructure gaps and unequal access to technology further restrict the reach of Green FinTech solutions, particularly in rural and semi-urban areas.

6. THEORETICAL PERSPECTIVES

6.1 Policy Context

Green FinTech is explained through institutional theory, which highlights how regulations, social expectations, and sustainability norms shape firm behaviour. Technology acceptance theories show that usefulness, ease of use, and trust drive users to adopt green digital finance. Stakeholder theory supports ESG integration since firms respond to demands for sustainability and accountability from investors, regulators, and society.

6.2 Practical Implications

FinTech firms are adopting green investment platforms, ESG-linked lending, and digital sustainability tools. Blockchain improves transparency, while AI supports better risk and investment decisions. However, adoption is limited by data gaps, low awareness, and infrastructure issues. Effective implementation requires technological innovation along with clear regulation, institutional support, and user education.

6.3 Policy Implications

Policymakers should standardise ESG metrics and green finance definitions to avoid confusion. Green FinTech sandboxes can support safe innovation. Incentives can increase participation in digital green finance. Digital and financial literacy must be improved for wider adoption. Coordination among regulators is essential for effective policy implementation.

7. FUTURE RESEARCH SCOPE

Future research should focus on empirical assessments of Green FinTech's environmental and economic impact, including carbon reduction and ESG performance outcomes. Firm-level and sector-specific studies can provide insights into organisational adoption drivers and barriers. Behavioural research examining user perceptions of digital green finance can inform product design and policy interventions. Comparative cross-country studies and evaluations of the environmental footprint of digital technologies will further enrich the Green FinTech literature.

8. CONCLUSION

Green FinTech represents a promising pathway for integrating digital innovation with sustainability objectives in India. While FinTech has transformed financial services, its contribution to sustainable finance remains underdeveloped. The study concludes that Green FinTech has significant potential to mobilise green investments, enhance transparency, and support climate-aligned financial decision-making. To realise this potential, policymakers should develop dedicated Green FinTech frameworks that integrate digital finance and sustainability goals. Financial regulators should introduce clear ESG reporting standards and encourage innovation through regulatory sandboxes. Financial institutions and FinTech firms should embed ESG considerations into product design and leverage digital technologies to support sustainable finance.

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THE BORDERLESS FLOW OF CURRENTS: HYDRO POLITICS, MEMORY AND WATER IN SARASWATI BY GURNAIK JOHAL

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ABSTRACT: ***Water has been a significant element in human civilisation as far as life, belief, memory, identity and political power are concerned. Within recent literature, the advent of Blue Humanities has seen a turn in land-centred criticism towards water-centred approaches. Blue Humanities suggests that rivers, seas and other water bodies must not be considered only as natural contexts, but there are dynamic elements of cultural, political and historical forces that define human existence. This paper reviews the Saraswati by Gurnaik Johal in the theoretical framework of Blue Humanities to explore the role of water as the power of fluidity in the story. The mythical Saraswati River is also re-invented in the novel, both as the icon of faith and a location of ecological memory, nationalism and political struggle. The river turns out to be a zone where belief collides with science and state ideology, and even conflicts. The paper also examines the ways in which water can be used as a cultural geographic identity and belonging, particularly when it comes to the diaspora communities who search for their roots in her imagined geographies. It also explores how the relations between humans and water determine their feelings, recollections and histories. This paper contends that Saraswati brings water out as the source of life and a contentious element through the symbolic and political roles of the returning river and how the fluid landscapes shape identity, power hierarchy and ecological awareness in modern literature..***

KEYWORDS: ***Hydro politics, Ecological Memory, Blue Humanities, Nationalism, Diaspora Identity.***

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1. INTRODUCTION

"A pond equals ten wells, a reservoir equals ten ponds, while a son equals ten reservoirs, and a tree equals ten sons" (*Matsya Purana* 154:512).

This ancient verse brings to the fore the cultural significance of water in the Indian mythology in a sacred and civilised manner. Water is not just a material resource, but a power, which keeps alive heritage, ecosystem, and memory. Such understanding has been extended in the context of modern literary research in the form of Blue Humanities, which redirects critical focus on land-oriented ecocriticism to water-oriented perspectives. Blue Humanities challenges the view of rivers, seas and oceans as natural backdrops, and presents rivers, seas and oceans as political and cultural agents that are shaping societies. It is possible to read Gurnaik Johal *Saraswati* (2025) in this theoretical framework. The novel recreates the mythical Saraswati River and uses its revival as a transformational process that influences the national identity, political organisation, and emotional belonging. The point presented in this article, *Saraswati*, is that water serves as flow power. The river returning into hydropolitics, ecological memory, nationalist fantasy and diasporic desire. By using the character of the river, Johal proves that water is a threat to borders, fixed identities, and collective memory. This paper seeks to explore how water is portrayed in the *Saraswati* by Gurnaik Johal in terms of Blue Humanities. It aims to examine the role of the nearby river Saraswati coming back, as a location of hydropolitical struggle, memory of ecology and national imagination. The article also attempts to examine the influence of water as a determinant of culture, diasporic belonging, and emotional memory in the story. In this study, the water in *Saraswati* is not just a symbolic component, but it is a kind of fluid power that is disorienting national borders and the politics of the ecological resources. It supposes that the novel attacks land-based nationalism with the presupposition of the borderless and dynamic quality of rivers.

The article discusses Blue Humanities as a trans-research approach, which studies the cultural, social, and ecological importance of the ocean and its connection to human experience. It provides the term of Oceo-Postcolonialism that introduces the idea of the ocean as a territory that is a product of colonial pasts and postcolonial present. Through the analysis of literary works in different postcolonial situations, the study shows that the ocean serves as a symbol of struggle, resistance, freedom and oppression. It also claims that Blue Humanities provides a novel framework in the interpretation of the interplay of aquatic spaces, colonial authority, and postcolonial identity, prompting the widening of postcolonial literary criticism.

2. BLUE HUMANITIES AND THE SHIFT FROM LAND TO WATER

The ecocriticism tradition has paid much attention to land, forest, and countryside. Nevertheless, Blue Humanities focuses on oceanic and riverine aspects of environmental thinking. Water is in motion, is aloof to containments and crosses political borders. It is movement and not stability. This land-to-water transition is important in the sense that land has traditionally been linked to ownership as well as territorial nationalism, and water is something that complicates these inflexible frameworks. The river is not just a setting in Saraswati. It is a dynamic force that shapes characters and political rhetoric. At the beginning of the novel, Johal asserts that "Something that could have been anything becoming one thing" (Johal 6). This sentence represents fluidity in water as well as identity. Water has potential and is unable to maintain a definite meaning. However, it has been tried to be defined and regulated by political forces. The shift between the possibility and this single meaning is also a reflection of the efforts of the state to create a single discourse concerning the river return.

(i) The Returning River and Ecological Memory

The *Saraswati* River, making a comeback, is central to the novel. It is the re-emergence of subjugated pasts and obscured geographies. Ecological memory is a concept that suggests that landscapes have remnants of the past. Although rivers may disappear or dry up, they remain remembered in cultural imagination. The feeling of the coming of the river back is reflected in the

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announcement: "To bring the river back! to return to the world our great river. It really is a deal that can't be better" (Johal 33). This is an indication of how the river turns into a gesture of renewal and pride. The payback, however, is not only ecological but very political. The river turns out to be a witness to the continuation of history and the greatness of civilisations. It implies in the narrative that the river is a memory bank. It relates shamanism to modern politics. *Saraswati* resurfacing conflicts with linear time and reinstates myth in the contemporary state discourse. In such a way, water becomes a channel of entry of the past and the present.

(ii) Hydropolitics: Nation, Belief, and Scientific Conflict

Hydropolitics is the political control and ideology of water resources. The river turns out to be a disputed territory of belief, science and nationalism in *Saraswati*. The novel is a clear depiction of the way in which water is being used to legitimise politics. Johal writes, "The Indus is a border river, a line at our periphery, but the centre of the nation- that, my friends, was the Saraswati. It was the greatest of all rivers, the mother of floods" (Johal 38). This is a nationalist rhetoric that makes the river the symbolic centre of the country. The geographical difference between the border and centre brings out the politicisation of geography. *Saraswati* is a device to forge national identity. Nevertheless, the novel does not portray such a story unconditionally. Johal makes the concept of greatness a challenge by saying that, "Greatness is always an alloy of good and bad" (Johal 67). This sentence implies that there are both nationalistic glorification implications. Although the river is honoured as a source of unity, its comeback also causes environmental imbalance as well as political interference. Hydro politics, therefore, brings out power as being ambivalent.

(iii) Rivers Beyond Borders: Partition and Fluid Identity

The fact that the river does not respect the boundaries of human beings is one of the strongest concepts in the novel. Water flows in spite of political boundaries. Johal attends to this point when he writes: "The rivers pay no attention to partition- the Indus, she just keeps running along" (Johal 294). This is a statement that questions the hardness of the boundaries of nationalism. The issue of partition that caused serious historical trauma seems superficial in comparison with ecological continuity. In this imagery, the novel criticises territorial nationalism. Borders are symbolised by rivers and unite the communities. They display artificiality of political lines. This fluid geography is what Blue Humanities focuses on because the author claims that water erodes rigid ideas of sovereignty. The river shows the boundaries of the state's control of the state in *Saraswati*.

(iv) Water, Emotion, and Diasporic Belonging

In addition to politics, the emotional and cultural aspects of water are also covered in the novel. There is a connection between rivers and power and strength. Johal says, "Strength from rivers" (Johal 243). This is a short but strong sentence that implies that water is a source of psychological grounding. It relates people to the ancestral landscapes. Memory and attachment are the determinants of the diasporic identity in the novel. The fact that cultural belonging is preserved using material things is evident in the line store sentence where the narrator says that "My dear mother embroidered this phulkari. I embrace it again and again with affection" (Johal 335). Rivers serve as emotive anchors just as the embroidered cloth can be a symbol of the memory of the homeland. To the diaspora communities, the river has not merely a physical existence, but also an imaginary continuity. It is difficult to convey the paradox of change and repetition with the help of the lyric: It's always a new river, always the same old train again (Stecher). The river is always and continuously historical. This is the duality that corresponds to the diasporic identity that negotiates the past and the present. Water is used as a symbol of the persistence of culture in movement.

(v) Pressure, Conflict, and Transformation

Geological metaphors are also employed by the author to explain social and political tension in the novel. "Without pressure, we wouldn't have diamonds" (Johal 319). This is an indication that a crisis brings about change. The resurgence of the river puts pressure on society. It escalates ideological discussions and reveals inconsistencies of nationalism. Water, in this case, acts as a catalyst. It makes

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communities deal with unresolved pasts and conflicting ideologies. Identity is reemerged by political and ecological pressure, much as pressure makes diamonds. The river, therefore, becomes a change process as opposed to a symbol.

3. CONCLUSION

In this article, *Saraswati* has been explored using Blue Humanities to anticipate the political, cultural and ecological meaning of water in the narrative. Through the examination of how the returning Saraswati River is a point of hydropolitical struggle, ecological memory and national imagination, the paper has revealed that water in the novel is fluid power or an active natural element. The river has turned into the place where belief, science, nationalism, and diaspora identity collide and contradict one another. By means of such intersection, Johal unveils the process of ecological bodies being used in the rhetoric of politics and the formation of memory by water scenery. Although the current interpretations of the novel are rather one-sided and simply look at its mythological and satirical aspects, the work at hand reveals a lack of research in exploring the river with the help of a water-based critical approach.

The presence of *Saraswati* in the context of Blue Humanities allows the paper to broaden the scope of thinking about the ways in which the modern South Asian fiction is concerned with the issues of hydropolitics and environmental awareness. The research area presented in this study creates an opportunity to carry out further research on the aquatic literary criticism, especially concerning the narratives of nationalism, partition and diaspora. *Saraswati* shows that rivers cannot be bound by national boundaries and ideological frameworks. Their flow is perceived to be a defiance against the strict territorial lines and the instability of the state power. Offering water as something sustaining and politicised, Johal emphasises the persistence of ecological thinking in the Anthropocene. The boundless nature of the movements of currents, thus, does turn into an effective reminder that memory, identity and power remain loose, flowing and constantly changing.

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A STUDY ON FINANCIAL INCLUSION AND INSURANCE AWARENESS UNDER PRADHAN MANTRI JAN SURAKSHA SCHEMES IN POLLACHI TALUK

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ABSTRACT: ***The Pradhan Mantri Jan Suraksha Schemes were introduced by the Government of India to promote financial security and social protection among economically vulnerable sections of society. These schemes include Pradhan Mantri Suraksha Bima Yojana (PMSBY), Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY), and Atal Pension Yojana (APY), which aim to provide affordable insurance and pension benefits. The present study focuses on analyzing the socio-economic profile of beneficiaries in Pollachi Taluk and examining their level of awareness, participation, and access to these schemes. Using primary data collected from 411 respondents through structured questionnaires, the study employs descriptive statistical analysis to examine demographic characteristics and awareness distribution. The findings reveal that beneficiaries mainly belong to rural areas, nuclear families, and lower income groups, with medium awareness levels about the schemes. The study highlights the importance of awareness programs and institutional support in improving participation and enhancing financial inclusion.***

KEYWORDS: ***Pradhan Mantri Jan Suraksha Schemes, Financial inclusion, Awareness and Perception.***

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1. INTRODUCTION

Financial inclusion plays a vital role in achieving inclusive economic growth and reducing financial vulnerability among citizens. In India, a significant portion of the population, particularly in rural and semi-urban areas, lacks access to formal financial protection mechanisms. To address this issue, the Government of India introduced the Pradhan Mantri Jan Suraksha Schemes to provide affordable insurance and pension coverage to the masses. These schemes aim to protect individuals and families against risks such as accidental death, disability, and lack of retirement security. Understanding the socio-economic characteristics of beneficiaries helps policymakers evaluate the effectiveness of these initiatives. This study examines the socio-economic profile, awareness level, and participation patterns of beneficiaries in Pollachi Taluk, providing insights into the implementation and outreach of the schemes.

1.1 **Objectives of the study**

To analyze the socio-economic profile, awareness level, and participation patterns of beneficiaries of Pradhan Mantri Jan Suraksha Schemes in Pollachi Taluk.

2. REVIEW OF LITERATURE

Sarma (2008) and Sengupta & Gupta (2015) have highlighted how financial inclusion impacts poverty alleviation, economic growth, and social equity. The Pradhan Mantri Jan Suraksha Schemes, introduced in 2015, have been a critical step toward achieving universal financial inclusion. According to Saha (2017), the PMJSS represent an attempt to provide affordable insurance coverage and a pension scheme to the unorganized sector. The schemes have seen substantial uptake, with millions of citizens enrolled across the country, particularly those who had no access to such services previously. Research focusing on beneficiaries' perception highlights mixed responses. Kumar and Mohanty (2018) reported that while beneficiaries generally appreciate the low cost and security offered by these schemes, their understanding of benefits and claim procedures remains limited. A study by Ramesh and Divya (2020) revealed that lack of awareness and inadequate communication from banks and post offices negatively affect beneficiaries' satisfaction levels, particularly in rural areas.

Overall, the literature suggests that Pradhan Mantri Jan Suraksha Schemes play a crucial role in advancing financial inclusion. However, beneficiary awareness, service quality, and effective communication remain critical challenges. Existing studies also highlight a research gap in linking beneficiaries' perception at the micro level with broader fiscal outcomes such as future taxation, especially in semi-urban regions like Pollachi Taluk.

3. SCOPE OF THE STUDY

Financial inclusion has emerged as a crucial driver of sustainable development by ensuring access to financial services for economically marginalized populations. In developing countries like India, the absence of adequate social security mechanisms exposes individuals to financial risks arising from accidents, health issues, and old age insecurity. Recognizing these challenges, the Government of India launched the Pradhan Mantri Jan Suraksha Schemes to provide low-cost insurance and pension solutions aimed at enhancing financial resilience.

Despite widespread implementation, the effectiveness of such schemes largely depends on beneficiaries' socio-economic characteristics, awareness levels, and institutional support mechanisms. Previous studies emphasize that demographic factors such as age, gender, education, occupation, and income significantly influence participation in financial inclusion initiatives. Therefore, analyzing the socio-economic profile of beneficiaries is essential for understanding outreach effectiveness and identifying gaps in policy implementation. Pollachi Taluk, characterized by a mix of rural and semi-urban populations, offers an appropriate setting to examine participation patterns in social security schemes. This study aims to analyze demographic characteristics, awareness levels, and enrolment

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trends among beneficiaries, contributing empirical insights to the discourse on financial inclusion and social protection in India.

4. RESEARCH METHODOLOGY

The study adopts a descriptive and analytical research design to examine the socio-economic profile, awareness level, and participation patterns of beneficiaries under the Pradhan Mantri Jan Suraksha Schemes. The research was conducted in Pollachi Taluk, Tamil Nadu, which serves as the study area. The target population consists of beneficiaries enrolled in the Pradhan Mantri Jan Suraksha Schemes within the selected region. A convenient sampling technique was used to select respondents for the study, and a total of 411 beneficiaries were included as the sample size. Primary data were collected through a structured questionnaire comprising Likert scale items to measure respondents' perceptions, awareness, and participation levels. The collected data were systematically analyzed to derive meaningful insights and support the objectives of the study.

5. SIGNIFICANCE OF THE STUDY

This study contributes to the growing body of literature on financial inclusion and social security schemes by providing empirical evidence from a localized context. It highlights how socio-economic factors shape awareness and participation in government initiatives. The findings offer insights for policymakers, financial institutions, and researchers by identifying gaps in awareness and suggesting strategies to enhance scheme outreach. Furthermore, the study adds to discussions on inclusive development by analyzing how low-cost insurance and pension programs can reduce financial vulnerability among marginalized populations.

6. AN OVERVIEW: JAN SURAKSHA SCHEMES & FINANCIAL INCLUSION

Pradhan Mantri Jan Suraksha Schemes refer to three flagship social security initiatives launched by the Government of India on 9 May 2015 to extend affordable insurance and pension coverage to underserved populations:

1. Pradhan Mantri Suraksha Bima Yojana (PMSBY) – accidental death/disability insurance.
2. Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY) – life insurance.
3. Atal Pension Yojana (APY) – old-age pension guarantee.

These schemes are closely linked to the Pradhan Mantri Jan Dhan Yojana (PMJDY), India's financial inclusion mission that brought millions into the formal banking system — providing savings accounts, RuPay debit cards, insurance, and overdraft facilities.

Together, these programmes aim to:

- Improve risk protection for the poor and informal workers.
- Increase insurance penetration and long-term savings.
- Strengthen financial inclusion by connecting marginalized groups to formal financial services.

7. FEATURES OF PRADHAN MANTRI JAN SURAKSHA SCHEMES AND THEIR ROLE IN FINANCIAL INCLUSION

The Pradhan Mantri Jan Suraksha Schemes possess several features that directly contribute to financial inclusion:

- Low Premium and Affordability: The schemes are designed with minimal annual contributions, making them accessible to low-income groups.
- Wide Institutional Coverage: Implementation through banks and post offices ensures extensive outreach, especially in rural and semi-urban areas.
- Automatic Debit and Simplicity: Premiums are auto-debited from savings accounts, encouraging regular participation and disciplined financial behavior.
- Risk and Old-Age Protection: Insurance and pension benefits provide financial security, reducing dependence on informal sources during emergencies.

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- Linkage with Bank Accounts: Mandatory bank account linkage promotes savings habits and familiarity with formal financial services.

Through these features, the schemes encourage individuals to remain connected with the formal financial system, thereby strengthening financial inclusion.

Table 1: Socio – Economic Profile of the Beneficiaries of Pradhan Mantri Jan Suraksha Schemes in Pollachi Taluk

Variables		**Frequency**	**Percent**
Area of Residence	City	84	20.44
	Town	135	32.85
	Village	192	46.72
	Total	**411**	**100.00**
Gender	Male	147	35.77
	Female	264	64.23
	Total	**411**	**100.00**
Age	18–27 years	132	32.12
	28–37 years	108	26.28
	38–47 years	96	23.36
	Above 47 years	75	18.25
	Total	**411**	**100.00**
Educational Qualification	Up to HSC	60	14.60
	Diploma	0	0.00
	UG	228	55.47
	PG	117	28.47
	No Formal Education	6	1.46
	Total	**411**	**100.00**
Occupation	Government Employee	21	5.11
	Private Employee	147	35.77
	Business	54	13.14
	Profession	18	4.38
	Agriculturists	36	8.76
	Daily Wages	111	27.01
	Others	24	5.84
	Total	**411**	**100.00**
Nature of Family	Joint Family	132	32.12
	Nuclear Family	279	67.88
	Total	**411**	**100.00**
Monthly Income	Up to ₹20,000	168	40.88
	₹20,001 – ₹40,000	135	32.85
	₹40,001 – ₹50,000	66	16.06
	Above ₹50,000	42	10.22
	Total	**411**	**100.00**
Awareness Level	High	48	11.68
	Medium	228	55.47
	Low	135	32.85
	Total	**411**	**100.00**
Awareness of Specific Jan Suraksha Schemes	PMSBY	246	59.85
	PMJJBY	192	46.72

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	APY	159	38.69
	Total	**411**	**100.00**
Enrollment in Jan Suraksha Schemes	PMSBY	222	54.01
	PMJJBY	168	40.88
	APY	141	34.31
	Total	**411**	**100.00**
Source of Awareness	Government websites	42	10.22
	Post office employees	51	12.41
	Bank employees	144	35.04
	Family members	48	11.68
	Friends/Relatives	69	16.79
	Media	57	13.87
	Total	**411**	**100.00**

Table 1 Interpretation:

- The majority of respondents belong to rural (village) areas, representing 46.72%.
- It is observed that the majority of the respondents are female, representing 64.23% of the total sample.
- The majority of respondents belong to the 18–27 years age group, accounting for 32.12%.
- The majority of the respondents are Undergraduate degree holders, representing 55.47% of the total sample.
- A greater percentage of respondents are private employees, accounting for 35.77%.
- The majority of respondents belong to nuclear families, accounting for 67.88%.
- The majority of respondents fall under the income group up to ₹20,000, representing 40.88%.
- The majority of respondents possess medium awareness, representing 55.47%.
- A large proportion of respondents are aware of PMSBY, accounting for 59.85%.
- A higher number of respondents are enrolled in pmsby, representing 54.01%.
- The majority of respondents learned about the scheme through bank employees, representing 35.04%.

Table 2: Age-wise Distribution of Awareness Level among Respondents

Age Group	High Awareness	Medium Awareness	Low Awareness	Total
18–27 years	18	72	42	132
28–37 years	12	63	33	108
38–47 years	9	54	33	96
Above 47 years	9	39	27	75
Total	**48**	**228**	**135**	**411**

Table 2 Interpretation:

Out of the total respondents, the majority fall under the medium awareness category across all age groups. Among the respondents aged 18–27 years, around 55% belong to medium awareness level, while nearly 32% show low awareness and only 13% demonstrate high awareness. Similarly, in other age categories such as 28–37 years, 38–47 years, and above 47 years, medium awareness dominates with more than half of the respondents. This indicates that awareness about Pradhan Mantri Jan Suraksha Schemes is moderate across different age groups, and only a smaller proportion shows high awareness.

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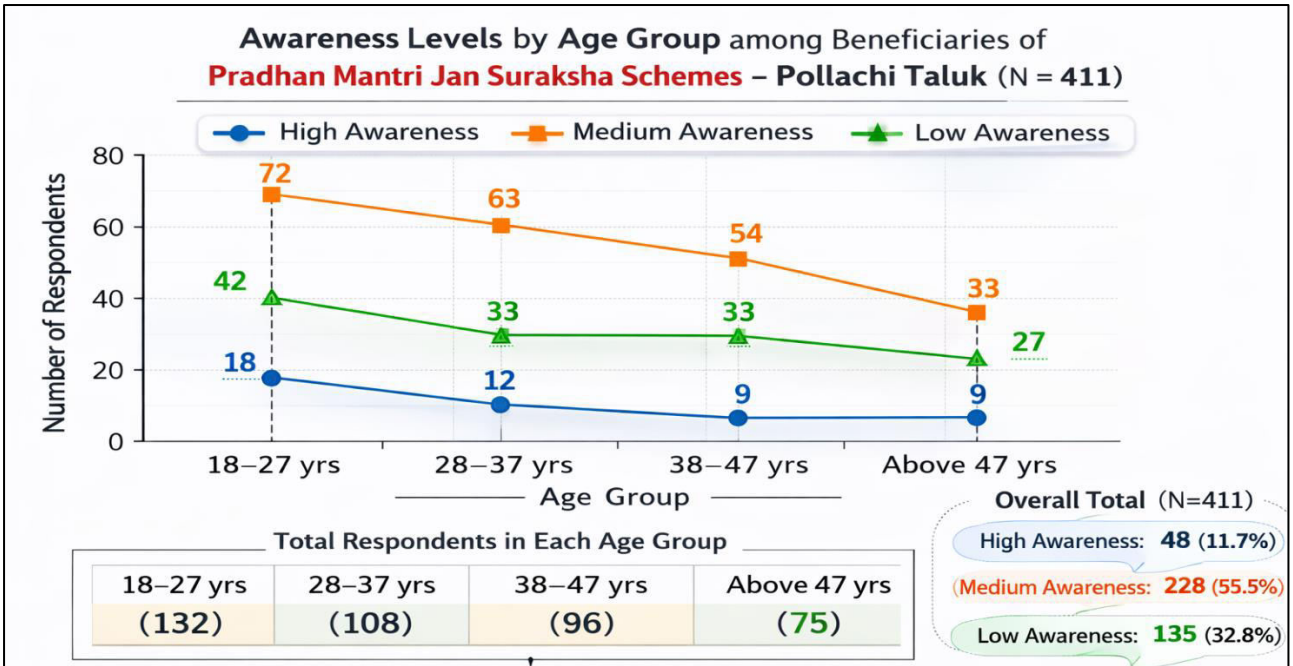

Figure 1: Awareness Levels by Age Group among Beneficiaries (Pollachi Taluk)

8. Conclusion

The study concludes that the Pradhan Mantri Jan Suraksha Schemes play an important role in promoting financial security and social protection among economically vulnerable populations in Pollachi Taluk. Although participation levels are encouraging, awareness remains moderate rather than high, indicating the need for stronger awareness campaigns and financial literacy initiatives. Banks and financial institutions play a crucial role in spreading information and facilitating enrolment. Strengthening outreach programs and simplifying procedures can further enhance participation and ensure broader financial inclusion.

9. Acknowledgement

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USING SIGHT WORD INSTRUCTION TO ENHANCE SPEECH INTELLIGIBILITY IN CHILDREN WITH SPEECH AND LANGUAGE DELAY

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ABSTRACT: ***Speech intelligibility is a major concern among children with speech and language delay, often affecting academic achievement, social interaction, and functional communication. Traditional speech intervention primarily focuses on articulation and phonological correction, with limited emphasis on integrating literacy-based strategies to support speech clarity. The present study examines the effectiveness of a structured sight word instruction program in enhancing speech intelligibility among children with speech and language delay. A pre-test–post-test experimental design was used with children aged 6–10 years diagnosed with mild to moderate speech and language delay. Functional sight words were introduced through a multisensory approach involving visual recognition, auditory modelling, repetition, and contextual use over eight weeks. Speech intelligibility and word production accuracy were measured before and after the intervention. Results indicated noticeable improvement in speech clarity, articulation accuracy, and functional communication. The findings suggest that sight word instruction, when integrated with structured pronunciation practice, supports both language and speech development. The study highlights the importance of combining literacy and speech-based approaches for holistic communication improvement. Implications for special educators, speech-language pathologists, and inclusive classroom practitioners are discussed.***

KEYWORDS: ***Sight Word Instruction, Speech Intelligibility, Speech and Language Delay, Multisensory Learning, Functional Communication, Special Education.***

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1. INTRODUCTION

Speech and language development is essential for effective communication, academic learning, and social participation. Speech intelligibility, defined as the degree to which a listener understands spoken language, is often reduced in children with speech and language delay. Poor speech clarity can result in limited classroom participation, communication frustration, reduced peer interaction, and low self-confidence. Therefore, early and effective intervention is crucial to support communication development in such children. Traditional speech therapy approaches primarily emphasize articulation training, phonological awareness, and oral motor exercises. Although these approaches improve sound production, they often focus on isolated sound practice rather than meaningful language use. Many children continue to struggle with speech clarity in everyday communication contexts. This limitation highlights the need for integrated instructional approaches that combine speech practice with language and literacy development.Sight word instruction, commonly used in early literacy programs, involves teaching children to recognize and produce frequently used words automatically without phonetic decoding. Repeated exposure to familiar words strengthens word recognition, pronunciation, and speech fluency. Multisensory teaching—combining visual, auditory, kinesthetic, and contextual methods—further enhances learning and retention. Integrating sight word instruction with speech practice provides meaningful opportunities for repeated verbal production, potentially improving articulation accuracy and speech intelligibility.

The present study investigates whether structured sight word instruction can enhance speech intelligibility in children with speech and language delay. By combining literacy-based learning with speech practice, the study aims to support clearer word production and functional communication.

2. REVIEW OF LITERATURE

- Speech intelligibility is fundamental to effective communication and is often compromised in children with speech and language delay. Research indicates that reduced intelligibility negatively affects academic and social participation. Traditional articulation-based therapy improves sound production but may not always support meaningful communication generalization.
- Sight word learning has been widely recognized in literacy research for improving automatic word recognition and language processing. Repeated exposure to familiar words strengthens phonological mapping and pronunciation accuracy. Studies on integrated language and literacy instruction suggest that combining word recognition with verbal expression improves expressive language and communication abilities.
- Multisensory instruction has also demonstrated effectiveness in supporting language and speech development. Combining visual, auditory, and kinesthetic input enhances memory, engagement, and learning outcomes. Functional communication research emphasizes the importance of meaningful word use in everyday contexts to promote speech clarity and participation. Despite strong evidence in literacy and communication research, limited studies have explored the role of sight word instruction in improving speech intelligibility, highlighting the need for the present study.

3. NEED FOR THE STUDY

Children with speech and language delay often struggle with speech clarity, affecting communication and academic performance. Traditional speech therapy focuses on sound production but may not fully address functional communication. Sight word instruction provides repeated and meaningful opportunities for verbal practice, potentially improving speech intelligibility. However, limited research exists on its effectiveness in speech intervention. This study aims to bridge this gap by examining the impact of sight word instruction on speech clarity and communication skills.

4. OBJECTIVES OF THE STUDY

1. To assess the baseline level of speech intelligibility in children with speech and language delay.

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2. To implement a structured sight word instruction program.
3. To evaluate the effect of sight word instruction on speech intelligibility.
4. To examine improvement in word articulation and functional communication.

5. HYPOTHESIS

H0: There will no significant improvement in speech intelligibility of children with CwSN in learning sight word.

6. METHODOGY

(i) Research Design:A pre-test–post-test experimental design was adopted.

(ii) Participants: The study included 10 children aged 6–10 years diagnosed with mild to moderate speech and language delay from a special education setting. Participants were selected through purposive sampling.

(iii) Tools Used:

- Speech Intelligibility Rating Scale
- Word Articulation Checklist
- Functional Communication Observation Sheet

(iv) Intervention Program: A structured 8-week sight word instruction program was implemented. Words included:

- Instructional Procedure
- Visual presentation using flashcards
- Auditory modeling by teacher
- Repetition and guided pronunciation
- Contextual usage in sentences
- Multisensory reinforcement
- Sessions were conducted 5 days per week, 30 minutes each.

(v) Data Collection: Pre-test conducted before intervention; post-test after completion.

(vi) Data Analysis: Mean scores and percentage improvement used for analysis.

7. RESULTS

Results indicated clear improvement in speech intelligibility and word articulation following the intervention.

Table 1: Shows the Improvement in Speech Intelligibility, Functional Communication and Word articulation

Measure	Pre-Test Mean	Post-Test Mean	Improvement
Speech Intelligibility	42%	71%	Significant
Word Articulation Accuracy	45%	76%	Significant
Functional Communication	48%	79%	Improved

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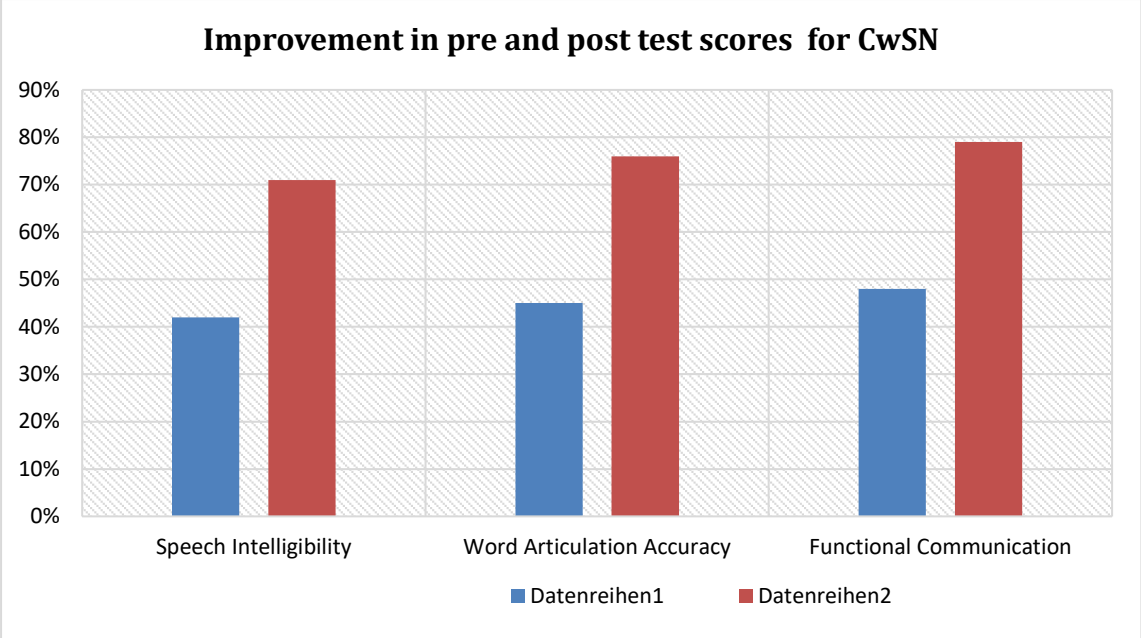

Figure 1: Improvement in Speech Intelligibility, Word Articulation and Functional Communication

7.1 Discussion

The findings indicate that sight word instruction positively influenced speech intelligibility. Repeated exposure and multisensory learning strengthen the word recognition and pronunciation accuracy. The study supports the view that integrating literacy and speech instruction promotes holistic communication development. Functional word use helped children generalize speech clarity into real-life communication contexts.

7.2 Educational Implications

- Useful for speech-language therapists and special educators
- Supports integrated literacy and speech instruction
- Enhances functional communication and participation
- Can be implemented in inclusive classrooms

7.3 Limitations

- Small sample size
- Short intervention duration
- Limited generalization data

7.4 Suggestions for Future Research

- Larger sample studies
- Long-term follow-up
- Technology-based sight word learning
- Comparison with traditional speech therapy

8. Conclusion

The study demonstrates that structured sight word instruction significantly improves speech intelligibility, articulation accuracy, and functional communication in children with speech and language delay. Integrating literacy-based strategies with speech intervention provides meaningful opportunities for repeated verbal practice, promoting clearer and more functional communication. This approach offers a practical and effective supplementary strategy for speech and language intervention programs.

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PSYCHOLOGY OF GREEN GUILT: FROM EMOTIONAL GUILT TO SUSTAINABLE PURCHASE BEHAVIOUR

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ABSTRACT: ***Despite increasing awareness of environmental issues, consumers often struggle to translate their concern into consistent sustainable purchasing behaviour. This study examines the role of green guilt in influencing consumers' intention and actual behaviour toward eco-friendly products, while also identifying the key factors that encourage or hinder such choices. Primary data were collected from 170 respondents using a structured questionnaire. The analysis reveals that green guilt is widely felt and encourages consumers to reflect on the environmental impact of their purchases. However, the rank analysis indicates that practical factors play a stronger role in influencing eco-friendly product choice. Lower price and easy availability emerged as the most important determinants, followed by clear eco-labels and product quality, while discounts and rewards had the least influence. These findings suggest that although emotional factors such as green guilt shape positive intentions, economic and situational factors ultimately determine actual behaviour. The study highlights the need to address affordability, accessibility, and clarity of information to effectively bridge the intention–behaviour gap in sustainable consumption.***

KEYWORDS: ***Green guilt, Sustainable consumption, Purchase intention, Consumer behaviour, Intention–behaviour Gap.***

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1. INTRODUCTION

In recent years, awareness about environmental issues has increased considerably, and many consumers are now more conscious of how their purchasing decisions affect the planet. However, this growing awareness does not always translate into action. A clear gap often exists between consumers' intentions to purchase sustainable products and their actual buying behaviour. This phenomenon commonly referred to as the ***intention–behaviour gap***, highlights the reality that even environmentally concerned consumers may continue to choose conventional products due to factors such as convenience, price sensitivity, or ingrained habits.

An important psychological factor contributing to this gap is ***green guilt***, which refers to the uneasy or guilty feelings consumers experience when they believe their choices are environmentally harmful. Green guilt can shape both the intention to act sustainably and actual purchasing behaviour. While feelings of guilt may encourage consumers to choose eco-friendly products, they can also result in avoidance or resistance, particularly when individuals feel overwhelmed by sustainability expectations or uncertain about the credibility of environmental claims. As a result, understanding the role of green guilt in consumer decision-making becomes crucial for promoting sustainable consumption.

Sustainable purchasing behaviour is further influenced by a range of psychological and social factors. Ethical concerns, such as a sense of responsibility toward the environment and future generations, can intensify guilt-driven motivations to make sustainable choices. Social norms shaped by family, peers, and broader societal expectations also play a significant role in guiding consumer behaviour. Additionally, trust in green marketing claims is a critical factor. When consumers suspect greenwashing or misleading information, their skepticism can reduce the impact of guilt and discourage sustainable purchasing decisions.

This study seeks to explore how green guilt influences consumers' intentions and actual behaviour when purchasing sustainable products, as well as to assess the gap between the two. It also examines the moderating roles of ethical concerns, social norms, and trust in green marketing claims in shaping guilt-driven sustainable consumption. By gaining deeper insight into these relationships, the research aims to offer practical recommendations for marketers and policymakers to encourage sustainable purchasing in ways that are effective, credible, and emotionally balanced.

2. PROBLEM STATEMENT

Today, many consumers express concern for the environment and show a willingness to support sustainable products. Yet, during actual purchasing situations, their choices often fail to reflect these intentions. This mismatch between what people plan to do and what they eventually do is referred to as the *intention–behaviour gap*.

A key factor contributing to this gap is *green guilt*, which arises when individuals feel uneasy about the environmental impact of their consumption. In some cases, this sense of guilt encourages consumers to make more responsible choices. However, it can also have the opposite effect. When people feel pressured or emotionally burdened, they may avoid engaging with sustainability issues altogether or rationalize their less sustainable choices.

Sustainable purchasing decisions are also shaped by several other influences. Ethical concerns, such as respect for animal welfare or support for fair trade practices, can strengthen environmentally responsible intentions. Social norms formed by the expectations of family, peers, and society further guide consumer behaviour. Additionally, trust in green marketing claims plays a crucial role. When consumers question whether products are genuinely eco-friendly, feelings of guilt may turn into doubt or frustration, reducing the likelihood of sustainable purchasing.

Against this backdrop, the present study seeks to explore how green guilt influences both consumers' intentions and their actual purchasing behaviour toward sustainable products. It also examines how ethical concerns, social norms, and trust in green marketing claims shape these decisions, helping to better understand the factors that either bridge or widen the intention–behaviour gap.

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3. OBJECTIVES OF THE STUDY

I. To examine how green guilt influences consumers' intention and actual behaviour toward purchasing sustainable products, and the intention–behaviour gap between them.
II. To evaluate the role of ethical concerns, social norms, and trust in green marketing claims in shaping guilt-driven sustainable consumption decisions.

4. REVIEW OF LITERATURE

Fehr, J. C. (2023) The study explores how guilt-based and empathy-based messages in green advertising influence the purchase intentions of consumers who identify as environmentally conscious. Using an experimental survey approach, participants were shown one of three types of advertisements—guilt-focused, empathy-focused, or neutral—and then asked about their willingness to purchase the advertised product. Surprisingly, empathy appeals did not perform better than guilt appeals. In fact, advertisements with no emotional appeal at all generated the highest purchase intention, followed by guilt-based messages, while empathy-based ads were the least effective. These findings suggest that emotional messaging does not always strengthen persuasion among green consumers and may sometimes backfire due to feelings of manipulation or emotional overload. The study emphasizes the importance of carefully framing sustainability messages and indicates that simple, factual, and non-emotional advertising may resonate more strongly with environmentally conscious consumers. Overall, the research challenges the assumption that emotional appeals are universally effective in encouraging sustainable product choices.

Nielsen, R. S., Gamborg, C., & Lund, T. B. (2024) The study looks at how people experience eco-guilt and eco-shame in their everyday lives and how these emotions shape their environmental behaviour. Through in-depth interviews, the authors identify common situations that trigger these feelings, including overconsumption, travel choices, and not meeting personal sustainability standards. The findings suggest that eco-guilt is usually linked to specific behaviours and often encourages positive action, such as cutting down on waste or choosing more sustainable products. Eco-shame, on the other hand, is tied to how individuals view themselves more broadly and can sometimes result in avoidance, denial, or disengagement rather than meaningful change. While both emotions influence environmental decision-making, guilt appears to be more effective in motivating pro-environmental behaviour. The study concludes that sustainability communication should use emotional appeals carefully; promoting a sense of responsibility without creating excessive shame that could weaken long-term commitment.

Kotchen, M. J. (2009) The article examines the concept of "green guilt" in the context of voluntary carbon offsets, questioning whether such offsets genuinely reduce greenhouse gas emissions or merely help consumers ease their environmental guilt. Kotchen explains that voluntary carbon offsets allow individuals to compensate for their emissions by funding environmental projects, such as reforestation or renewable energy initiatives. While the offset market has grown rapidly due to rising climate awareness and emotional appeals, the author argues that its overall impact on climate change remains limited. From an economic perspective, voluntary offsets function like charitable contributions to a public good and therefore suffer from free-rider problems. However, the article acknowledges that offsets can provide psychological benefits, such as guilt alleviation and increased environmental awareness, which may encourage participation. Kotchen concludes that while carbon offsets are better than inaction, they should not replace direct efforts to reduce emissions and must be supported by stronger standards and regulation to ensure real environmental benefits.

5. RESEARCH METHODOLOGY

This study uses a descriptive research approach to understand how green guilt influences consumers' intentions and actual behaviour toward purchasing sustainable products. Primary data were collected from 170 respondents through a structured questionnaire. The respondents came from different age

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groups and income levels, allowing the study to capture a range of consumer perspectives. A convenience sampling method was used, as it made it easier to reach participants who were willing to share their views. The questionnaire included simple statements and multiple-choice questions that focused on feelings of green guilt, purchase intentions, real buying behaviour, and the reasons consumers continue to choose non-eco-friendly products despite being environmentally aware. The responses were analyzed using percentage analysis, rank analysis, and chi-square tests to identify patterns and examine the influence of demographic factors on purchasing decisions.

6. RESULTS AND DISCUSSION

Table 1: Green Guilt and Consumer Psychology

S.No	Consumer perception	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Rank
1	I feel guilty when I buy products that are harmful to the environment.	30	64	36	5	5	3
2	I feel uneasy when I ignore eco-friendly alternatives while shopping.	28	60	42	8	2	1
3	I believe my consumption choices contribute to environmental problems.	32	56	42	6	4	2
4	Feelings of guilt make me reconsider my purchasing decisions.	28	60	40	10	2	4
5	I feel responsible for reducing environmental damage through my purchases.	30	70	32	6	2	5
	TOTAL	148	310	192	35	15	

Source: Primary data

The responses clearly show that green guilt is a common and meaningful experience for consumers, rather than an abstract or distant concept. A large proportion of respondents agree that they feel guilt, discomfort, and responsibility when their purchasing choices negatively affect the environment. This suggests that environmental concerns are emotionally embedded in consumers' everyday decision-making. The very small number of respondents who disagreed indicates that rejection of green guilt is minimal, reinforcing its psychological relevance.

Many respondents reported feeling guilty when buying products that harm the environment and uneasy when they ignore eco-friendly alternatives. This highlights that green guilt can arise both after making an unsustainable purchase and at the moment of choosing convenience over sustainability. The strong agreement with the belief that personal consumption contributes to environmental problems reflects an internalized sense of responsibility, where consumers recognize their own role in environmental degradation rather than attributing it solely to external actors.

The findings also show that guilt often prompts reflection, with many respondents agreeing that feelings of guilt make them reconsider their purchasing decisions. This indicates that green guilt functions as a self-regulating emotion, encouraging consumers to think more carefully about the consequences of their choices. The strongest agreement observed in feelings of responsibility for reducing environmental damage suggests a growing perception of sustainability as a personal moral obligation.

However, the notable presence of neutral responses points to a gap between awareness and action. While consumers may acknowledge environmental responsibility and experience guilt, these feelings

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do not always translate into consistent sustainable behaviour. Practical constraints such as price sensitivity, convenience, and limited access to eco-friendly products may weaken the impact of green guilt on actual purchasing decisions, reflecting the broader intention–behaviour gap in consumer psychology.

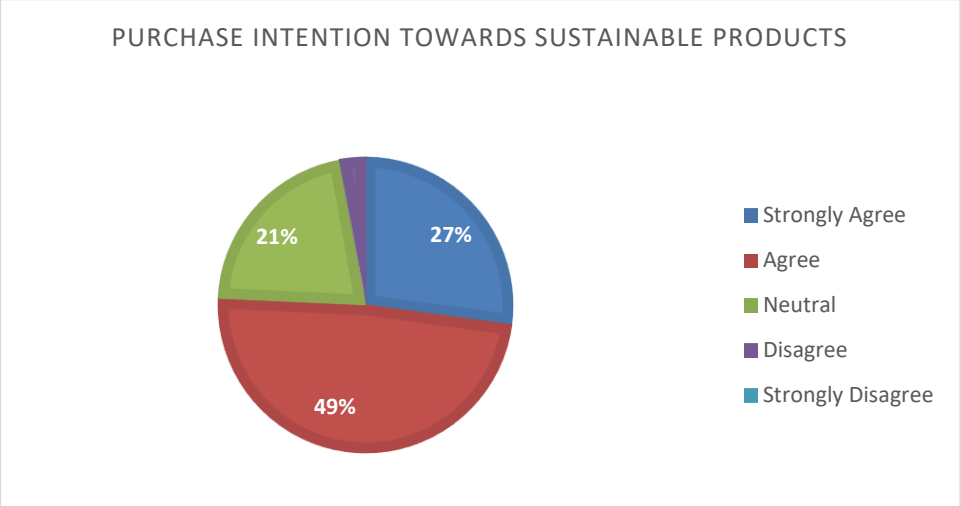

Chart 1: Purchase Intention towards Sustainable Products

Source: Primary data

The chart shows that most people genuinely want to buy sustainable products. Nearly half of the respondents agree that they intend to choose sustainable options, and more than a quarter strongly agree. This clearly suggests that positive attitudes toward sustainability are already in place and that many consumers feel inclined to make environmentally responsible choices when shopping.

At the same time, about one-fifth of respondents remain neutral. This group likely represents consumers who care about sustainability but feel unsure or conflicted when it comes to actual purchases. Factors such as higher prices, limited availability, or lack of clear information may make them hesitate, even though they do not oppose sustainable products.

Very few respondents express negative intentions, with only a small percentage disagreeing and almost none strongly is disagreeing. This shows that resistance to sustainable consumption is minimal. Instead, the real challenge lies in helping consumers move from *wanting* to buy sustainable products to *actually* doing so. Overall, the chart reflects a hopeful picture—people are largely on board with sustainability, but they need the right support, incentives, and convenience to turn good intentions into everyday purchasing habits.

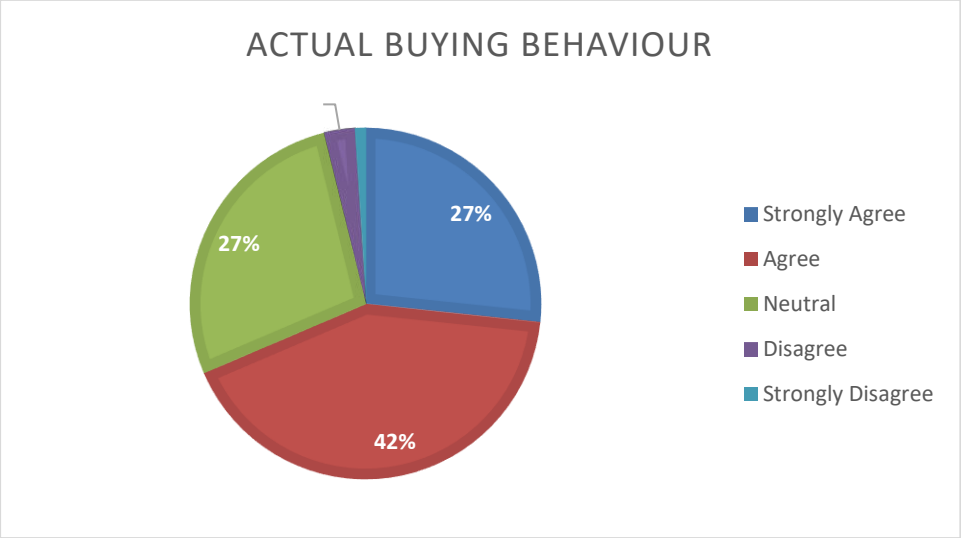

Chart 2: Actual Buying Behaviour

Source: Primary data

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The chart shows how people actually behave when it comes to making purchases, giving a more realistic view than simply asking what they *intend* to do. While many respondents still report positive sustainable behaviour, the strength of that commitment seems a bit weaker in practice. About 42% say they regularly make eco-friendly purchases, and another 27% strongly agree, showing that a good number of consumers do try to make sustainable choices when they can.

At the same time, around 27% remain neutral, which suggests that what people *say* they do and what they *actually* do don't always match up. This group probably represents those who buy sustainable products occasionally, but not consistently often because of everyday hurdles like price, convenience, habit, or limited availability.

Only a small fraction of respondents report negative behaviour, meaning very few actively avoid sustainable products. Overall, the chart highlights a noticeable gap between positive attitudes and real-world purchasing habits. It shows that while people care about sustainability, turning that concern into regular action isn't always easy.

Table 2: Factors Driving the Purchase of Environmentally Harmful Products Despite Environmental Awareness

S.No	Reason for Purchase	Number of Responses	Percentage
1	It is more affordable than eco-friendly alternatives	48	24
2	Eco-friendly alternatives are not easily available	36	18
3	I prioritize convenience and comfort	32	16
4	I am influenced by brand image or advertisements	22	11
5	I doubt whether eco-friendly products actually make a difference	20	10
6	I lack sufficient information about sustainable alternatives	18	9
7	Social pressure or habits influence my purchase decisions	14	7
8	I do not consider environmental impact at the time of purchase	10	5

Source: Primary data

This multiple-choice question shows that even when people know a product is harmful to the environment; their buying decisions are often driven by practical reasons. Most respondents chose "It is more affordable than eco-friendly alternatives", followed by limited availability and convenience, indicating that cost and ease matter more than concern at the moment of purchase.

Other reasons such as the influence of brands, doubts about eco-friendly products, lack of information, and habitual buying also play a role. Overall, the results highlight a common gap between what people care about and what they actually do while shopping, especially when money, access, and convenience are involved.

Table 3: Social and Situational Influences on the Adoption of Eco-Friendly Products

S.No	Reason for buying Eco-friendly products if	Number of Responses	Percentage
1	My friends/family also use them	92	46
2	It is the default option	84	42
3	It is recommended by influencers	66	33
4	It is widely used by others	78	39
5	It gives social recognition	54	27

Source: Primary data

The findings show that social surroundings play a strong role in encouraging the adoption of eco-friendly products. Nearly half of the respondents (46%) reported purchasing eco-friendly products because their friends or family members also use them. This highlights the importance of close social

circles in shaping environmentally responsible behavior, suggesting that people are more likely to adopt sustainable products when such choices are normalized within their immediate environment.

Additionally, 42% of respondents indicated that they choose eco-friendly products because they are presented as the default option, showing that convenience and system-driven choices significantly influence consumer decisions. Products being widely used by others also had a noticeable impact, with 39% of respondents stating this as a motivating factor, reinforcing the idea that collective behavior and social acceptance encourage sustainable consumption. Recommendations by influencers influenced 33% of respondents, indicating a moderate impact of digital and public figures on eco-friendly purchasing decisions. In contrast, social recognition was the least influential factor (27%), suggesting that most consumers are motivated more by practical and social conformity reasons rather than the desire for social status.

Table 4: Factors Influencing choice of Eco Friendly products

S.No	Factors	Mean Rank	Sum of Rank	Final Rank
1	Lower price	2.32	320	1
2	Easy availability	2.36	326	2
3	Clear eco labels	2.46	340	3
4	Better quality/ performance	2.48	342	4
5	Discount/ rewards for green choices	2.51	346	5

Source: Primary data

The rank analysis shows that **price is the most important factor** influencing the choice of eco-friendly products. Consumers are more willing to buy sustainable options when they are affordable. **Easy availability** is ranked second, highlighting that convenience strongly affects eco-friendly purchasing decisions. **Clear eco-labels** come next, indicating that consumers value simple and trustworthy information when identifying green products. **Product quality or performance** is ranked fourth, suggesting it matters, but less than price and access. **Discounts or rewards** rank last, showing that incentives alone are not enough to drive sustainable choices. Overall, the results suggest that making eco-friendly products affordable, accessible, and clearly labeled is more effective than relying on promotional offers.

Table 5: Chi-Square Test Results for Age, Gender, and Monthly Income

S.No	Demographic Factors	Variable	P- Value	Chi Square value	Results
1	Age	Reason for Buying Non-Eco Products Despite Guilt	0.042	25.61	Significant
2	Gender		0.051	11.03	Not Significant
3	Monthly Income		0.003	34.82	Highly Significant

Source: Primary data

The chi-square analysis was carried out to understand whether age, gender, and monthly income are related to the reasons why consumers continue to purchase non-eco-friendly products despite feeling guilty. The results show that age has a significant relationship with the stated reasons for such behavior ($\chi^2 = 25.61$, $p = 0.042$), suggesting that people from different age groups justify their choices in different ways. In contrast, gender does not show a significant association with the reasons for purchasing non-eco-friendly products ($\chi^2 = 11.03$, $p = 0.051$), indicating that both male and female respondents tend to report similar reasons such as price, convenience, or habit. On the other hand, monthly income shows a highly significant association with the reasons for continuing non-eco purchases ($\chi^2 = 34.82$, $p = 0.003$), highlighting that income level plays an important role in shaping consumer decisions. Lower-income respondents are more likely to be influenced by price, while higher-income groups appear to consider other factors. Overall, the findings suggest that age and income

significantly influence consumer behavior, whereas gender does not have a meaningful impact on the reasons for purchasing non-eco-friendly products despite feelings of guilt.

7. RECOMMENDATIONS

1. **Focus on Affordable Pricing:** Since lower price ranked as the most influential factor, businesses and policymakers should work toward reducing the cost of eco-friendly products through subsidies, incentives, or cost-efficient production methods.
2. **Improve Product Availability:** Easy availability was identified as a key driver of eco-friendly choices. Retailers should ensure that sustainable products are widely accessible across both online and offline platforms.
3. **Strengthen Eco-Labeling Practices:** Clear and trustworthy eco-labels help consumers identify sustainable products quickly. Standardized and transparent labeling can reduce confusion and build confidence in green claims.
4. **Maintain Product Quality and Performance:** Eco-friendly products should meet consumer expectations in terms of quality and usability to encourage repeat purchases and long-term adoption.
5. **Use Incentives as Supportive Tools:** Discounts and rewards should be used as supporting measures rather than the main strategy, as they were found to have the least influence on consumer choice.

8. CONCLUSION

The study demonstrates that green guilt plays a meaningful role in shaping consumer attitudes toward sustainable consumption. Most consumers recognize their responsibility toward the environment and express a willingness to make eco-friendly choices. However, this willingness often weakens during actual purchasing situations due to practical barriers such as cost, convenience, limited access, and uncertainty about the authenticity of sustainable products. While green guilt encourages self-reflection and moral responsibility, it does not automatically lead to sustained behavioural change. The findings also highlight the importance of social and situational factors, particularly social norms and default options, in encouraging eco-friendly purchasing. The significant influence of age and income further suggests that sustainable consumption is shaped by both emotional and economic considerations. Overall, the study concludes that reducing the intention–behaviour gap requires more than emotional motivation. A combination of credible information, supportive social environments, and accessible sustainable options is essential to encourage long-term environmentally responsible consumer behaviour.

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WOMEN, STORYTELLING, AND PUSHBACK: GENDER INEQUALITY IN THE NOVELS OF GITHA HARIHARAN

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ABSTRACT: ***This paper takes a deep look at the work of Githa Hariharan through a feminist lens, focusing on her novels The Thousand Faces of Night, The Ghosts of Vasu Master, and Time of Siege. The study explores how Hariharan portrays the lives of women within complex systems like patriarchy, caste, power in institutions, and nationalistic ideas. Using feminist literary theory, postcolonial feminism, and the idea of intersectionality, the paper shows that Hariharan's stories not only reveal how gender discrimination works in society but also show how storytelling itself can be a form of resistance. She looks into how traditional family roles, being left out of professional opportunities, old myths, and community conflicts affect women's lives. Through this, she shows how women's experiences are broken but also strong and capable of change. The paper highlights that Hariharan's writing techniques, like using many voices, rethinking myths, and focusing on inner thoughts, are ways to fight against the dominant structures in families, governments, and culture. In the end, her novels show that storytelling is a powerful way to bring back forgotten stories and create new, better possibilities for women.***

KEYWORDS: ***Patriarchy, Intersectionality, Women's agency, Discrimination, Violence, Nationalism, Freedom of Education, Caste, Class, and Community.***

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1. INTRODUCTION

Githa Hariharan is a writer and scholar known for her work on gender discrimination, feminist literary criticism, Indian English fiction, patriarchy, intersectionality, women's agency, and narrative resistance. In India, gender discrimination is a big problem that affects women and people of other genders in many areas of life.This discrimination has been around for a long time and is deeply connected to the idea that men should be in charge, which is called patriarchy. This idea is supported by family, religion, caste, and the government. It leads to women and gender minorities not having the same chances as men in education, jobs, healthcare, owning property, and making decisions. Even though there are laws that say everyone should be treated equally, social norms still make men more important and women and other genders less valued. Traditionally, in India, men have been seen as the main leaders in families and society.

This idea comes from old religious texts and traditions that give men more power. When British people ruled India, there were discussions about things like widows burning themselves alive (sati), marrying as children, and widows getting married again. People like Raja Ram Mohan Roy and Ishwar Chandra Vidyasagar pushed for changes to improve women's rights, but even then, women were often seen as symbols of tradition rather than as individuals who can make their own choices. Today, gender discrimination is still a big issue in India.Even with more education for women, there are still more men who can read and write. Women don't get to work as often as men, and when they do, they often get paid less. Things like giving money as a dowry, preferring boys over girls, and even stopping girls from being born show how much society values boys more than girls. Violence against women, like abuse at home, harassment, and even killings for being disrespectful, shows how unsafe and powerless women often feel because of the way men have always been in control.

Gender discrimination in India is connected with other factors like caste, class, religion, and whether someone lives in a rural or urban area. Women from poorer or less powerful groups face more difficulties because they are excluded from society and economic opportunities. For example, Dalit and Adivasi women often suffer from both caste-based and gender-based violence, showing that we need to look at how different forms of discrimination work together to create inequality. At the same time, India has had many feminist movements and changes in the law.

The Indian Constitution says everyone is equal before the law and stops discrimination based on gender. There are also laws like the Dowry Prohibition Act (1961), the Protection of Women from Domestic Violence Act (2005), and rules about workplace harassment that aim to fix unfair treatment. Local activism, women’s groups, and better education have also helped women gain more control over their lives. However, just having laws that say everyone is equal doesn’t mean people treat each other equally. Old ideas about men being in charge still affect how women are seen and treated in daily life. These ideas shape what women are expected to do, how mobile they can be, what they can do with their bodies, and how much they can work. So, gender discrimination in India exists both in the way systems are built and in the beliefs people have inside themselves. In writing and cultural studies, gender discrimination is a big topic.

Writers show how women deal with unfair systems and fight back. Indian English novelists especially look at the struggle between old traditions and new ways of living, between taking care of the home and wanting to work, and between staying quiet and standing up for themselves. Through these stories, literature helps start important discussions about fairness, equality, and change in Indian society. In short, gender discrimination in India is a complicated issue that comes from history, culture, and economic conditions. Even though there have been some improvements through laws and social changes, there are still big inequalities that need more attention and action from everyone.

In the late 1900s, a new wave of Indian women writers started writing in English, which changed how people talk about gender issues in literature. Earlier stories often showed women as symbols of sacrifice, tradition, and morality, but these new writers started to question those ideas. One of these writers is Githa Hariharan, who has a special place in this movement.

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Githa Hariharan is a well-known writer from India who focuses on feminist ideas, retells myths, and explores topics like gender, identity, and nationalism in postcolonial India. She was born in 1954 in Coimbatore, Tamil Nadu, and grew up in different cities. She studied at the University of Bombay, now called University of Mumbai, and later earned a postgraduate degree from Fairleigh Dickinson University in the United States.Her writing career took off with her first book, "The Thousand Faces of Night" (1992), which won a major award called the Commonwealth Writers' Prize for Best First Book. This book retells Indian myths from a feminist perspective and looks at how women are limited by traditional beliefs about men.

Some of her other important books are:

- When Dreams Travel – A new version of "The Arabian Nights" that focuses on women's voices and power.
- In Times of Siege – A political story about nationalism, freedom of education, and how history is remembered.
- Fugitive Histories – Set during times of conflict and community tension in India.
- I Have Become the Tide – Explores how caste discrimination affects people and the movements against it.

Githa Hariharan's writing often deals with:

- Gender inequality and control by men
- The role of myths in understanding women
- Personal identity and self
- Religious and community divisions
- How history and memory are shaped

She is also involved in activism. In 1999, she fought against unfair laws that limited a mother's rights in legal matters, and she won a major Supreme Court case that helped make the law fairer for womanist Hariharan holds an important position in Indian English literature because she does a lot of things that make her work unique.

She retells old myths from the point of view of women, gives a voice to people who are often ignored, and mixes beautiful writing with a critical look at society and politics. Her books are widely used in universities, especially in classes that study feminism, postcolonialism, gender, and Indian writing in English.In India, discrimination against women happens in both obvious and hidden ways. Even though there have been legal changes and better education, strong traditional attitudes still affect how women move around, express their sexuality, and think for themselves. Literature plays a big role in showing these issues. Hariharan's novels show how this discrimination continues not just through direct violence, but also through everyday actions that support unfair gender roles. These roles are found in myths, marriage, workplaces, and national stories.

This research paper looks at how women and gender discrimination are shown in three of Hariharan's major novels.

2. OBJECTIVES OF THE PAPER

The paper wants to answer these questions:

I. How does Hariharan show gender discrimination in homes, institutions, and political areas?
II. What ways do her female characters find to take control within a system that is not fair to women?
III. How do the stories she tells act as a form of resistance against patriarchy?
IV. How does the idea of intersectionality, which looks at how different aspects of identity like race, class, and gender affect people, change how we see gender in her writing?

By carefully looking at the texts and using different theories, this paper argues that Hariharan's novels create a voice that challenges traditional ideas about men and women, and gives women the power to tell their own stories.

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3. THEORETICAL FRAMEWORK

This study uses feminist literary criticism as its main way of understanding the texts, along with postcolonial feminist theory and the idea of intersectionality. Simone de Beauvoir's idea that "one is not born, but rather becomes, a woman" shows how gender roles are created by society. Hariharan's stories show this process, showing how girls are shaped by myths, family, and the education system into people who follow rules.

Judith Butler's idea of gender performativity helps us understand how femininity is created through repeated actions, like wedding ceremonies, daily chores, and modesty rules. These actions make it seem like being a woman is natural, but they actually support unfair treatment.

(i) Judith Butler's Theory of Gender Performativity

Judith Butler says:

- Gender is not something you are born with.
- It is something you do.
- It is performed through actions, speech, behavior, and how you dress.
- These repeated performances make people believe that gender is natural.

According to Butler, society pushes people to follow certain gender roles through rules and punishments. People who don't fit these roles face being shunned, criticized, or even harmed. So, gender discrimination happens when people are forced to follow strict rules of how to be a man or a woman.

(ii) Application to Githa Hariharan's Novels

Hariharan's novels show how Butler's theory works in real life. Her female characters are always forced to act in ways that are considered acceptable for women in a male-dominated society.

In "The Thousand Faces of Night", Devi grows up listening to stories about women who are obedient and willing to sacrifice. These stories act like a guidebook for how to behave as a woman.

Butlerian Reading:

- Devi is taught to act like the perfect wife.
- Marriage becomes a situation where she has to show she is submissive, quiet, and controlled in her emotions.
- Her sense of self is built not from her own desires but from repeating actions that society says are proper for women.
- When Devi finally leaves her marriage, she breaks the cycle of acting like the perfect woman.

According to Butler, this breaking of routine shows that gender roles are made up, not natural.

So, gender discrimination in the novel happens because of:

- What society expects from women
- Myths passed down through culture
- Pressure from family

Institutional Gender Regulation in "The Ghosts of Vasu Master "In "The Ghosts of Vasu Master", women who work professionally, like Lakshmi Rao, face unfair treatment in educational settings. Butler explains that society sets rules for how women should act. Women who act too confidently or too independently are punished.

In the novel:

- Lakshmi's skills challenge the power of men.
- People doubt her ability to do her job well.
- Her personality is questioned.

She is not punished for not doing her job but for not acting like a quiet, obedient woman.

The school becomes a place where gender roles are enforced. This shows Butler's idea that gender norms are kept in place through watching and controlling how people behave.

(iii) **Gender and Nationalism in In Times of Siege:** In "In Times of Siege", women are connected to the idea of what a nation is.In Butler on Gender and Power, Butler says that ideas about

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gender are connected to bigger political systems. The government often creates an idea of what a perfect woman should be to keep control.

(iv) In the novel:

- Women are seen as protectors of culture.
- Their bodies become symbols of tradition.
- Their freedom is less important than the nation's identity.
- Here, treating women badly is part of politics.
- They are valued in symbols but not in real life

(v) Repetition and Resistance

According to Butler, resistance happens when people break the usual ways of showing gender. In Hariharan's fiction:

- Devi leaves her marriage.
- Women speak about experiences that are hidden.
- Myth stories are looked at differently.

These actions shake up the usual ideas about what a woman should be. By not repeating the old patterns, women show that the rules of patriarchy are not natural. Crenshaw's idea of intersectionality is especially useful. In Hariharan's fiction, being treated unfairly because of gender is connected with other things like caste, class, and community. Women's experiences depend on their social and economic situation, but all are limited by the same patriarchal rules. Postcolonial feminism, as discussed by people like Chandra Talpade Mohanty, questions the idea that all women in the "Third World" are the same.

Hariharan's fiction stops people from seeing all women as the same by showing the different stories of women in specific cultural settings.

4. Gender And Mythic Conditioning In "The Thousand Faces Of Night"

"The Thousand Faces of Night" by Githa Hariharan is a strong feminist book that shows how myths and gender together shape women's lives in a patriarchal Indian society. The novel mixes real life with stories from myths to show how cultural stories create and control what it means to be a woman. Hariharan doesn't just tell old stories; she changes how they're told to show how they help keep unfair ideas about women alive.

(i) Myth as a Way to Teach Gender Roles

Devi grows up listening to myths told by her grandmother. These stories come from ancient texts and religious traditions. They praise women who are kind, patient, and willing to suffer.

Myth becomes:

- A way to teach right and wrong
- A picture of what a perfect woman should be
- A reason for women to accept pain

By hearing these stories again and again, young girls learn to think that being quiet and strong is what makes a woman good. In this way, myths help keep women in a lower place in society

Characters like:

- Sita
- Savitri

Show loyalty, purity, and love. These women are seen as the best examples of how real women should act. In the novel: Devi is expected to act like these characters. Marriage means being patient and giving up personal happiness. Feelings of sadness or anger must be kept inside.

(ii) Marriage as a Myths Goal

The story treats marriage not just as a way to live, but as a destiny that women are meant to follow.

Some of the rules about gender in the story include:

- A woman's joy comes from being married.
- Being obedient brings peace.
- wife becomes part of her husband's life.

Devi's arranged marriage fits this idea, but the loneliness she feels shows how different life is from the stories. Hariharan shows how myths make marriage sound wonderful while ignoring how much control they put on women.

Quietness and Suffering as Good Traits

Another part of the myth is making silence and endurance seem like good things.

Women like Mayamma face bad treatment but rarely speak up.

Silence is seen as:

- Power
- Superiority
- Steadfastness

But Hariharan shows that this silence lets pain and injustice continue. The myths teach women to accept what happens to them instead of fighting back

Myths and Women's Feelings

Old stories often hide women's personal desires, seeing strong women as bad or wrong.

In the novel:

- Devi's thoughts and feelings are ignored.
- Her dreams for the future don't fit with what society expects of her.

Hariharan brings attention to Devi's inner conflicts, which makes people wonder why women's desires are always seen as something to control.

(iv) Changing Myths to Fight Back

Although myths are used to control women, Hariharan uses them to challenge unfair ideas.

She Changed stories to show women's points of view & said more about women who aren't often heard. She has given new meanings to old myths.

Generational Transmission of Gender Myths

The novel shows three generations—Mayamma, Sita, and Devi—each influenced by myths in different ways.

- Mayamma accepts her oppression.
- Sita deals with limits as best as she can.
- Devi starts to question and finally resists.

This change across generations shows a slow shift in how women think about themselves.

(v) Intersection of Myth and Social Reality

Hariharan shows that myths are not just old stories; they are part of everyday life today.

Even in educated urban families, they still: Expect women to sacrifice. Give more power to men. Control what women can do. So, myths are deeply connected to how society works.

The Thousand Faces of Night tells the stories of three generations of women—Devi, her mother Sita, and Mayamma. The novel mixes mythological tales with real-life experiences, showing how myths act as tools to control behavior.

From a young age, Devi learns about mythic women who are obedient and willing to suffer. These stories act like lessons that shape her beliefs. Myths become a quiet but strong way to support gender inequality, making suffering seem like a sign of being a good woman. Marriage in the novel is a key example of how men control women. Devi's arranged marriage keeps her trapped in traditional roles. Her smart ideas are ignored, and her feelings are not understood. Marriage is shown as a way to keep women quiet and obedient.

Mayamma's sad life shows the harsh effects of being economically and socially dependent. Her story highlights how being a woman can lead to both emotional and physical harm. Through

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Mayamma, Hariharan shows that the harm caused by men's power is both seen and felt. But the novel doesn't end with defeat.

Devi's decision to leave her husband is a big change. This step shows her taking back control of her story. Importantly, the novel doesn't paint rebellion as something easy or perfect. It shows that fighting back has challenges and isn't always a clear win. Resistance is seen as a continuous process, not a single victory.

5. INSTITUTIONAL PATRIARCHY IN "THE GHOSTS OF VASU MASTER"

In "The Thousand Faces of Night" looks at domestic patriarchy, "The Ghosts of Vasu Master" focuses on institutional structures. Educational settings, often seen as forward-thinking, are actually deeply affected by gender issues. Lakshmi Rao is a highly educated woman who faces a difficult work environment. Even though she has strong qualifications, she deals with harassment and unfair attacks on her character.

Institutional patriarchy works through silence and support from the system. Male leaders use rules and procedures to make women's complaints seem invalid. The novel shows how reputation can be used as a tool. Women's words are always questioned, while men's mistakes are ignored. This is a form of gender discrimination called epistemic injustice, where women's knowledge and experiences are not taken seriously.

Hariharan criticizes how male-dominated ideas shape intellectual authority. Schools and universities, instead of being equal spaces, help keep old power structures in place. Through this, the novel broadens the feminist view beyond just the home.

In "The Ghosts of Vasu Master", Githa Hariharan gives a clear look at how gender discrimination affects relationships, roles, and personal freedom, especially for women. The story takes place in a school, which lets Hariharan show how subtle and clear forms of sexism work through the way characters interact and their views on tradition, power, and gender roles. Significance of Gender Discrimination in the Narrative By placing gender discrimination in the everyday life of a school, Hariharan:

- Reveals how sexism can be normal in places that are supposed to be progressive, like schools and education systems. Shows how gender bias works quietly instead of openly, through small actions and expectations that keep inequality going.
- Makes readers think about the unfair power structures based on gender.

In "Ghosts of Vasu Master", gender discrimination isn't just shown as personal bias but as a bigger problem that affects how people are respected at work, how authority is seen, and how individuals express themselves.

Hariharan's careful storytelling makes readers realize how sexism can stay hidden in everyday situations, changing how people relate to each other and supporting old ideas about men being in charge.

"In Times of Siege" puts gender in the middle of heated political conflicts.The book shows how nationalist ideas use women's bodies to stand for tradition and cultural purity. Women are seen as protectors of heritage, but they aren't given a say in political matters. Gender discrimination works through beliefs that force women into roles of moral symbols.

Hariharan shows how community tensions make women more vulnerable. Women are pushed to the side both because they come from minority groups and because of the traditional roles they are expected to follow in their homes. The pressure from politics and family life makes their situation even harder. The book uses many different voices to break apart simple nationalist stories. Women's stories help correct old misunderstandings and offer new ways to look at identity.

In both novels, gender discrimination doesn't happen alone.

It mixes with other problems like:

- depending on others financially

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- being treated differently because of your caste
- being part of a certain religion
- not having access to education

Hariharan doesn't split things into just victims and those who hurt them. Instead, she shows women as part of complicated social groups. Even women who have some advantages, like education, might still face limits because of what is expected of them in marriage. Women who are already left out face even more difficulties. So, understanding how different forms of discrimination work together are key to seeing Hariharan's feminist ideas clearly a myth revisionism. By changing how myths are told, Hariharan challenges traditional cultural stories. Instead of just following old myths, she makes them a place where people can argue and question.

Interior Monologue

The focus on what women think inside counters the way history has ignored their voices.
Readers get to see thoughts that were once kept hidden.

Fragmented Structure

The stories are not in a straight line, which shows how women's identities are broken up by different pressures and expectations. Through these methods, the story itself becomes a form of resistance.

Comparative Perspective

When we look at other writers like Shashi Deshpande, Anita Desai, and Mahasweta Devi, Hariharan stands out because she mixes myth retelling with political ideas. While Deshpande looks at everyday life and Desai explores deep feelings, Hariharan brings in bigger social and political issues. Her stories connect personal experiences with society as a whole, showing how unfair treatment of women happens everywhere in life.

- Silence, Voice, and Agency
- Silence is a big theme in her books.
- Women are taught to stay quiet and not speak up. But silence is also shown as a moment for thinking before speaking.
- Voice is powerful.

When characters like Devi leave, or Lakshmi Rao stands up, or when people tell stories in In Times of Siege, speaking out is a way to gain freedom. But Hariharan doesn't present a simple happy ending. She shows that having power is not always easy, and it depends on many factors like domesticity and spatial politics. Space has symbolic meaning. Homes can feel like places of limitation, but they can also be places of safety. Workplaces offer freedom but often support traditional male roles. Public spaces can make women feel watched and judged.

Hariharan shows how gender discrimination is connected to the way we organize space.
She shows that the way we divide up space is influenced by gender.

- Reimagining Female Subjectivity
- Hariharan does not show women as simply victims.
- Her characters are thoughtful, questioning, and smart. Even when they are trapped, they have inner strength and independence.
- This shows that women in some parts of the world are not all the same.
- Their thoughts and feelings can change and grow.

The Politics of Storytelling

Hariharan's writing shows how telling stories is a way to challenge unfair power.
Stories shape how we see the world. By rewriting old stories and history, women take control of how their experiences are shared. Storytelling becomes a way to fight back against the dominant ideas that support unfair treatment of women.

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6. CONCLUSION

Hariharan's novels offer a strong critique of how gender inequality is built into everyday life, institutions, and national ideas. Through her work, we can see that patriarchy uses many ways to control people – including stories, marriage, work roles, and the way we think. But her books do more than just show how people are treated unfairly. They show how women can fight back through stories and by expressing their own voices. By focusing on women's experiences, she turns literature into a tool for change. Her books are still very important in modern India, where discussions about fairness for women are ongoing. They remind us that changing the way we think is just as important as changing the laws.

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EMPOWERMENT OF TRIBAL WOMEN IN FOREST-BASED LIVELIHOODS: AN ANALYTICAL STUDY OF GOVERNMENT MEASURES IN SOUTHERN KERALA

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ABSTRACT: ***Tribal women in Kerala constitute a vital component of forest-based livelihood systems, particularly in the collection and marketing of Non-Timber Forest Products (NTFPs). Despite their significant economic contribution, they have historically faced socio-economic marginalization, limited market access, price instability, and inadequate institutional support. The Government of Kerala, through agencies such as the Kerala Forest and Wildlife Department and the Scheduled Tribes Development Department, has implemented targeted interventions including Vanasree outlets, Van Dhan Vikas Kendras (VDVKs), and the Minimum Support Price (MSP) scheme for Minor Forest Produce to enhance income security and promote women's empowerment. The present study adopts a descriptive and analytical research design and is based on primary data collected from 60 tribal women engaged in forest resource collection and marketing in Southern Kerala. Data were gathered through a structured interview schedule and analyzed using percentage and tabular methods. The findings reveal moderate awareness and active participation in government schemes, with a majority of respondents reporting improvement in income and socio-economic status. However, persistent challenges such as price fluctuations, transportation constraints, and limited value-addition infrastructure continue to affect livelihood sustainability.***

KEYWORDS: ***Tribal Women; Non-Timber Forest Products (NTFP); Government Interventions; Vanasree; Van Dhan Vikas Kendra; Livelihood Empowerment; Southern Kerala; Forest-Based Economy; MSP for MFP; Socio-Economic Development.***

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1. INTRODUCTION

Kerala, known for its rich biodiversity and forest resources, is home to several Scheduled Tribe communities who traditionally depend on forests for their livelihood. A significant proportion of tribal women are actively engaged in the collection and marketing of Non-Timber Forest Products (NTFPs) such as honey, medicinal plants, bamboo products, and wild spices. These activities contribute substantially to household income and food security.

Recognizing the socio-economic vulnerabilities of tribal women, the Government of Kerala has implemented various measures through institutions such as the Kerala Forest and Wildlife Department, Scheduled Tribes Development Department, Kudumbashree Mission, and Kerala State Forest Development Agency. Programs such as Vanasree, Van Dhan Vikas Kendras, MSP for MFP, and women-oriented livelihood schemes aim at enhancing income, eliminating middlemen exploitation, and promoting value addition and entrepreneurship.This study attempts to evaluate the effectiveness of such measures among tribal women in Southern Kerala.

2. STATEMENT OF THE PROBLEM

Tribal women in Southern Kerala have traditionally depended on forest resources for their livelihood, particularly through the collection and marketing of Non-Timber Forest Products (NTFPs) such as honey, medicinal plants, bamboo, and wild spices. Although the Government of Kerala has introduced several welfare and livelihood support schemes through agencies like the Kerala Forest and Wildlife Department and the Scheduled Tribes Development Department, many tribal women continue to experience socio-economic vulnerabilities. These include price instability, inadequate storage and transportation facilities, and limited awareness about government schemes, low educational attainment, and restricted access to formal markets.

While institutional mechanisms such as Vanasree outlets, Van Dhan Vikas Kendras, and MSP schemes aim to ensure fair pricing and value addition, their actual effectiveness at the grassroots level requires empirical evaluation. It remains unclear whether these measures have substantially improved income levels, strengthened market participation, and enhanced the socio-economic empowerment of tribal women. Therefore, there is a need to systematically examine the extent to which government interventions have succeeded in uplifting tribal women engaged in forest resource collection and marketing in Southern Kerala.

3. REVIEW OF LITERATURE

Yogi, R., Singh, A., Kumar, N., & Sharma, K. (2018)) conducted a comparative study on procurement and marketing practices of Minor Forest Produce in Andhra Pradesh and Orissa. The study revealed lower procurement costs in Andhra Pradesh and exposed exploitation by intermediaries in both states.

N. Vijaykumar and K.N. Ushadevi (2022) investigated the problems faced by women tribals in the collection and marketing of NTFPs in Kerala. The study highlighted issues such as middlemen exploitation, lack of market access, and inadequate institutional support.

Pokhrel, D., & Thapa, G. (2007). (2019) made an attempt to know about Tribal Farmer's Agricultural needs and Accessibility in Attappady Block Palakkad district. It also tries to examine the channels of information communication and sources of information used by women tribal farmers.

The tribal women contribute significantly to family income through collection of forest produce and participation in eco-development activities, their opportunities for formal market access, leadership in cooperative structures, and equitable income remain constrained, necessitating targeted policy support for empowerment and inclusive development.(https://vanasree.in/)

4. NEED AND SIGNIFICANCE OF THE STUDY

The present study is necessary because tribal women constitute a vital yet economically vulnerable segment of Kerala's forest-dependent population. Their contribution to the collection and preservation

of forest resources is substantial, yet their economic returns often remain marginal due to structural disadvantages and market inefficiencies. Evaluating the effectiveness of government schemes provides crucial insights into whether policy initiatives have translated into tangible improvements in livelihood security, income stability, and social empowerment.

5. OBJECTIVES OF THE STUDY

I. To analyse the socio-economic profile of tribal women engaged in forest resource collection.
II. To examine awareness and participation in government schemes.
III. To evaluate the impact of government measures on income and livelihood security.
IV. To identify challenges faced in marketing forest products.

6. METHODOLOGY

The present study adopted a descriptive and analytical research design to examine the effectiveness of government measures for the upliftment of tribal women engaged in the collection and marketing of forest resources in Southern Kerala. The study was primarily based on primary data collected from 60 tribal women respondents selected from forest fringe areas using a convenience sampling method. Data were gathered through a structured interview schedule to ensure clarity and reliability, considering the educational background of the respondents. Secondary data were obtained from reports and publications of the Kerala Forest and Wildlife Department, Scheduled Tribes Development Department, and related official documents to support the analysis. The collected data were classified, tabulated, and analysed using percentage analysis and simple descriptive statistical tools, and the results were presented in tables to substantiate the objectives of the study.

7. ANALYSIS AND INTERPRETATION OF DATA

Table 1: Age Profile of Respondents

Age	No.of respondents	Percentage
Below 30	12	20
30–40	22	37
40–50	18	30
Above 50 8 13.3%	8	13
Total	60	100

Interpretation: Majority (37%) belong to 30–40 years age group, indicating active working population involvement.

Table 2: Educational Qualification

Qualification	No. of respondents	Percentage
Illiterate	15	25
Primary	20	33
Secondary	18	30
Higher Secondary & Above	7	12
Total	60	100

Interpretation: Educational attainment is low; 58.3% have only primary or no formal education.

Table 3: Awareness of Government Schemes

Scheme	Awareness	Percentage
Fully Aware	24	40
Partially Aware	26	43
Not aware	10	17
Total	60	100

Interpretation: Though awareness is moderate, complete awareness remains limited.

Table 4: Participation in Government Programs (Vanasree / VDVK / MSP)

Participation level	No	Percentage
Active Participant	32	53
Occasional	18	30
Not Participating	10	17
Total	60	100

Interpretation: More than half actively participate, showing scheme penetration.

Table 5: Change in Income after Government Intervention

Change in income	No.	Percentage
Significant Increase	20	33
Moderate Increase	25	42
No Change	10	17
Decrease	5	8
Total	60	100

Interpretation: 75% experienced improvement in income, indicating positive impact.

Table 6: Major Problems Faced in Marketing

Problem	No.	Percentage
Price Fluctuation	18	30
Transportation Issues	14	23
Lack of Storage	12	20
Limited Market Access	10	17
Middlemen Exploitation	6	10
Total	60	100

Interpretation: Price instability and transportation issues are major challenges.

8. FINDINGS OF THE STUDY

(i) Majority respondents are middle-aged women actively engaged in forest-based livelihoods.
(ii) Educational level is generally low.
(iii) Awareness of schemes is moderate but not universal.
(iv) More than half participate in Vanasree and related initiatives.
(v) Government interventions have positively influenced income levels.
(vi) Price fluctuation remains a major issue.
(vii) Marketing infrastructure needs strengthening.
(viii) Training and value addition improved earning capacity.
(ix) Women reported increased self-confidence and social participation.
(x) Seasonal dependency on forest produce still affects income stability.

9. CONCLUSION

The Government of Kerala has undertaken several commendable measures to uplift tribal women engaged in forest resource collection and marketing. Institutional mechanisms like Vanasree, Van Dhan Vikas Kendras, and MSP for MFP have reduced exploitation and enhanced income opportunities. The integration of livelihood schemes with women empowerment initiatives has improved socio-economic conditions to a considerable extent.

However, gaps remain in awareness, infrastructure, storage facilities, and price stabilization. Strengthening market linkages, improving training, ensuring consistent MSP implementation, and expanding value-addition units can further enhance the sustainability of tribal women's livelihoods.

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PHYSICOCHEMICAL CHARACTERISTICS AND ANTIOXIDANT POTENTIAL OF AMARANTHUS VIRIDIS

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ABSTRACT: ***Phytochemical composition like physical & biological composition, Amino acids profile, Antioxidant profile, mineral content and of dried leaves of Amaranthus Virdis were evaluated using standard methods of analysis. The leaves had the following proximate compositions on dry weight ash 21.05%, Total protein of 23.33 ± 3.17 g/100g, Total lipid content of 5.26 ± 0.30g/100g , total dietary fiber of 14.04 ± 0.35g/100g, total carbohydrate of 46.58 ± 1.49 g/100g and total calorific value of 251.17 ± 1.26 kcal/100g. The leaves boast high levels of K, Mg. Tannins and phytates were the main antinutrients, alongside notable amounts of total and soluble oxalates. The amounts of FRAP 21.7 ± 0.80 mg AA/g , Vitamin C 21.41±1.32g/100g , Total phenolics content (TPC) was found (5.12±0.6 mg GAE/g) , Total flavonoid content (TFC) was 17.5±0.36 mg RE/g dw , The 2,2 – diphenyl-1-picrylhydrazyl (DPPH) was 67.45 ± 1.95 % , 62.33± 2.51 mg/100g of sodium and potassium value of 2391.33 ± 1.52 mg/100g were below the critical values that show it was a good source of antioxidants.***

KEYWORDS: ***Leafy Vegetables, Amaranthus Virdis, Nutrients, Antioxidant, Antinutrient***

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1. INTRODUCTION

Amaranthus viridis, commonly known as amaranth, had belonged to the Amaranthaceae family, encompassing 60–75 species (Viljoen et al., 2018). It consists of approximately 60–70 species grouped into three sub-genera: *Amaranthus Albersia* (vegetable amaranth), *Amaranthus Amaranthus* (cultivated grain amaranth), and *Amaranthus Acnida* (weedy amaranth) (Jamalluddin et al., 2022). It also had high genetic and phenotypic diversity, which may provide an excellent opportunity for varietal development with increased drought tolerance characteristics (Jamalluddin et al., 2022). Amaranth had been distinguished by species cultivated for grain, leafy vegetables, and ornamentals, broadly categorized as leafy greens or grain types. Leaves are excellent sources of minerals (manganese, copper, zinc, phosphorus, iron, potassium, magnesium, and calcium), protein with essential amino acids (lysine and methionine), and dietary fiber (Sarker et al., 2014). Grain amaranths resembled as small cereals, with protein-packed seeds cooked like rice, popped like popcorn, and valued as staples in ancient civilizations, including India, despite recent healthy food popularity (Massey et al ., 2018) . In India, *Amaranthus viridis* had been widely cultivated in 17 states like Jammu & Kashmir, Gujarat, and Tamil Nadu, though national production data is unavailable (Rahman et al ., 2025) . Cosmopolitan across tropical and temperate zones, the genus includes annuals, short perennials, vegetables, pseudocereals, ornamentals, and weeds. Plants had produced catkin-like flower clusters in summer/autumn, varying in green-to-crimson hues, growing 1–2.5 m tall on fibrous stems. About 10 of 75 species were dioecious North American natives; others were monoecious worldwide except Antarctica (Steckel et al., 2021). Named from Greek amárantos ("unfading") for persistent flowers, grain types have grown in the 1970s–80s in the U.S. states like Nebraska and are ongoing in China (150,000 ha for forage). Leafy types (*A. dubius, A. cruentus, A. tricolor*) had been consumed in Africa, Asia, and the Americas, thriving in humid tropics. Known locally in India as chaulai, keerai, or khada saga, amaranth has served nutrition via cooked leaves and versatile grains for breads, pastas, and traditional foods (Gandhi et al ., 2021) . Naturally gluten-free, rich in protein, fiber, minerals, and antioxidants, it has been linked to anti-inflammatory, cholesterol-lowering, and weight-management benefits (Saduakhasova et al., 2025). Genetic improvement had relied on traditional selection until genomics and biotech expanded enhancements for nutrition and stress tolerance (Das et al., 2016). Amid reliance on rice, wheat, maize, and amaranth's C4 pathway and nutrients had positioned it for climate-resilient systems, though research lagged major crops. This article examined phytochemical and antioxidant analysis of *Amaranthus viridis*, identifying flavonoids and assessing capacity via DPPH & ABTS assays for health benefits from its tropical secondary metabolites.

2. MATERIALS AND METHODS

2.1 Sample Collection and Preparation

The sample was sourced from the local market of Burla (21.8·N&83.88·E), district: Sambalpur, Odisha, India. Aerial parts, leaves, air-dry at room temperature, grind into powder (40-60 mesh), and store in an air-tight container at 4ºC. This sample was subjected to extraction via sonication and centrifugation. Sequential extraction used hexane, ethyl ether, ethyl acetate, methanol, and water via maceration (1:10 w/v, 48-72h) or Soxhlet (6-8h).

2.2. Physical Analysis

The pH of *Amaranthus viridis* was determined using a digital pH meter (EUTECH, PH700-S2) to measure hydrogen ion concentration (Jayanetti et al., 2024). Moisture content was estimated by weighing approximately 5 g of the prepared sample into a pre-weighed petri dish and recording the weight (W_2). The sample was then dried in a preheated hot air oven (ALLYONE, AO/OV-20-S1) at 105 °C for 24 hours until a constant weight was obtained (Akpabio & Akpakpan, 2012). Total ash content was determined by the dry ashing method, in which the sample was incinerated in a muffle furnace to remove organic matter, leaving inorganic mineral residue (Pyar et al., 2018). Bulk density of

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Amaranthus viridis powder was measured by accurately weighing a known mass (M) of the sample and transferring it into a 25 mL graduated measuring cylinder, after which the occupied volume was recorded (Khalequzzaman et al., 2009).

Figure-1: Processing and preparation of *Amaranthus viridis*

2.3 Biochemical Analysis

Total carbohydrate content was estimated by the Anthrone method (Funik et al., 2011). Approximately 0.3 g of dried powder was subjected to acid hydrolysis so that complex carbohydrates were converted into simple sugars. A glucose standard series was prepared to generate the calibration curve. One milliliter each of standards, blank, and sample extract was transferred into labeled test tubes, followed by addition of 4–5 mL freshly prepared anthrone reagent in concentrated H_2SO_4. The mixtures were thoroughly mixed and heated at 90 °C for 10 minutes. After cooling, the developed green coloration was measured at 620 nm, and carbohydrate concentration was calculated from the standard curve. Total protein was determined according to the Lowry method (Aliva et al., 2021). The powder sample was homogenized in distilled water and was centrifuged, and the supernatant was collected and diluted appropriately. One milliliter of BSA standard or sample solution was treated with 5 mL alkaline copper reagent (Reagent A:B, 50:1) and was incubated for 10 minutes. Subsequently, 0.5 mL of 1 N Folin–Ciocalteu reagent was added, and the mixture was incubated in the dark for 30 minutes. Absorbance was recorded at 660/750 nm, and protein content was derived from the standard calibration curve. Total fat content was determined using the Soxhlet extraction method (Arampath et al., 2024). Approximately 10 g of finely ground sample was dried at 102 °C and was placed in a thimble. Extraction was carried out with 90–150 mL petroleum ether for 6 hours until the solvent in the siphon tube appeared clear. The solvent was evaporated, and the residue was weighed to calculate fat content. Dietary fiber was estimated by a modified ultrasound-assisted alkaline extraction technique as described by (Devi et al ,. 2022). For starch determination, the sample was soaked in 0.3% NaOH solution and was blended, followed by filtration and centrifugation (Jayanetti et al., 2024). The sediment was repeatedly washed and centrifuged until a clear supernatant was obtained. The residue was neutralized

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to pH 6–7 and was dried at 40–45 °C prior to quantification. Sodium (Na) and potassium (K) contents were quantified using flame photometry as described by (Musa and Akpomie et al., 2022).

2.4 Antioxidant Content

Total phenolic content (TPC) in *Amaranthus viridis* was determined by the Folin–Ciocalteu method as described by (Aliva et al., 2021). One gram of dried sample was extracted using 80% methanol or acetone, followed by filtration and volume adjustment. The extract was reacted with diluted (1:10) Folin–Ciocalteu reagent and sodium carbonate. Absorbance was recorded at 765 nm, and TPC was quantified using a gallic acid calibration curve. Total flavonoid content (TFC) was estimated according to the standard aluminum chloride colorimetric procedure (Chutipaijit et al., 2018; Aliva et al., 2021). An aliquot (1 mL) of extract was diluted to 3 mL and treated sequentially with 0.03 mL sodium nitrite, incubated for 5 min at 25 °C, followed by 0.03 mL of 10% aluminum chloride and 0.2 mL of 1 mM sodium hydroxide. Absorbance was measured at 510 nm and results were expressed using a quercetin standard curve. The DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay was conducted using 80% ethanol extracts (10–40 µg/mL) mixed with 0.1 mM DPPH solution (Aliva et al., 2021). The reaction mixture was incubated in the dark for 30 min, and absorbance was measured at 517 nm. Percentage inhibition was calculated in comparison with ascorbic acid as the reference standard. Vitamin C content was determined by titration with standardized 2,6-dichlorophenolindophenol (DCPIP) dye (Aliva et al., 2021). A 5 g sample was extracted using 3% metaphosphoric acid, filtered, and titrated to a pale pink endpoint. Ferric reducing antioxidant power (FRAP) was assessed using methanolic extracts reacted with freshly prepared FRAP reagent composed of acetate buffer, TPTZ, and ferric chloride in a 10:1:1 ratio (Aliva et al., 2021). The mixture was incubated at 37 °C for 4–10 min, and absorbance was recorded at 593 nm.

2.5 Total calorific count of *Amaranthus viridis*

Make sure the *Amaranthus viridis* was fully dry, then grind about 1 g into a fine powder, press it into a pellet, and record its mass (mf). Place the pellet in the bomb calorimeter crucible, attach the fuse wire, add 2 litres of distilled water, seal the bomb, and pressurize it with oxygen (25–30 atm). Submerge the bomb in the calorimeter bucket with a known water mass (mw), allow the system to stabilize, and note the initial temperature (Ti). Ignite the sample and record the highest temperature reached (Tf). After the run, turn off the stirrer, release the pressure, check for complete combustion, and clean the bomb (Aliva et al., 2021).

3. RESULT AND DISCUSSION

3.1. Physical analysis of *Amaranthus Virdis*

The physical characteristics had been determined using standard analytical procedures described in Section 2.2 (Methods). The pH value had been recorded as 5.6, which had been found to be close to the value of 6.5 previously reported (Dev et al., 2018). Moisture content had been observed at 7.17 ± 1.04% on a dry weight basis, which had fallen within the 6–9% range documented for leafy vegetables commonly consumed in Nigeria (Odhav et al., 2007). Ash content, reflecting total mineral residue, had been measured at 21.05 ± 0.30% (DW). This level had been reported to exceed those documented for other edible leaves such as *Vernonia colorata* (15.86% DW) and *Moringa oleifera* (15.09% DW) (Lockett et al., 2000), as well as *Solanum americanum* (17.40% DW) and *Momordica balsamina* (18.00% DW) (Hassan and Umar, 2006). Bulk density had been determined as 0.5 g/cm³. The dry leaf powder of *Amaranthus viridis* had been shown to exhibit bulk density values ranging from 0.40–0.65 g/cm³, which had been found comparable to *Amaranthus tricolor* (0.45–0.70 g/cm³) and slightly lower than *Spinacia oleracea* (0.60–0.80 g/cm³). Variations had been attributed to particle size distribution and drying techniques (Fellows, 2009; Onwuka, 2005).

3.2. Biochemical analysis of *Amaranthus Virdis*

The carbohydrate content of *Amaranthus viridis* leaves had been estimated at 46.58 ± 1.49 g/100 g (DW), which had been reported to be higher than that of *Senna obtusifolia* leaves (20%) (Faruq

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et al., 2002) and comparable to *Amaranthus incurvatus* (23.7%) (Asibey-Berko and Tayie, 1999). However, lower carbohydrate levels had been observed in *Momordica balsamina* (39.05%) (Hassan and Umar, 2006). The protein content had been determined as 23.33 ± 3.17 g/100 g (DW), which had exceeded values reported for *Momordica balsamina* (11.29g/100g), *Moringa oleifera* (20.72g/100g), *Lesianthera Africana* (14.90g/100g), *Solanum americanum* (11.33g/100g), and *Leptadenia hastata* (19.10g/100g) (Isong and Idiong, 1997; Sena et al., 1998; Lockett et al., 2000; Hassan and Umar, 2006). Based on the recommended dietary allowance of 0.80 g/kg body weight/day (FND et al., 2002), 100 g of dried leaves had been calculated to supply approximately 62.7% of the daily protein requirement for a 70-kg adult. The lipid content (5.26 ± 0.30 g/100 g DW) had been found to be lower than the range reported for several Nigerian vegetables (Ifon and Bassir, 1980; Sena et al., 1998), and such low lipid levels had been considered beneficial for weight management. Dietary fibre (14.04 ± 0.35 g/100 g DW) had fallen within the reported range for Nigerian vegetables (8.50±20.90g/100g) (Ifon and Bassir et al., 1980). Although high fibre intake had been associated with reduced nutrient bioavailability (Aletor and Adeogun, 1995; Plessi et al., 1999; Vadivel and Janardhanan, 2000), protective effects against chronic diseases had also been documented (Gorecka et al., 2000; Ishida et al., 2000; Ramula and Rao, 2003). Total starch had been recorded as 44.72 ± 4.88 g/100 g, whereas leafy tissues of *Amaranthus viridis* had generally been characterized by low starch levels (1–3% DW) compared with cereal grains such as *Oryza sativa* and *Zea mays*, and amaranth grains of *Amaranthus cruentus* (Rastogi & Shukla et al., 2013).

Table 1: Physiochemical parameter analysis of *Amaranthus viridis*

Sample name	Ph	Moisture Content (%)	Total Ash Content (g/100g)	Bulk density (g/cm^3)	Starch content (g/100g)	Dietary fiber (g/100g)	Total carbohydrate (g/100g)	Total protein (g/100g)	Total fat (g/100g)
Amaranthus viridis	5.5	(7.17± 1.04% dry weight	21.05±0.03g/100g	0.5g/cm^3	44.72±4.88 g/100g	14.04±0.35 g/100g	46.58 ± 1.49 g/100g	23.33 ± 3.17 g/100g	5.26±0.30g/100g

3.3 Antioxidant analysis of *Amaranthus Virdis*

The total phenolic content (TPC) of *Amaranthus viridis* dried leaf powder was found to be 5.12±0.6 mg GAE/g dry weight. This level was reported to be comparable with *Amaranthus tricolor* (15–35 mg GAE/g) but relatively lower than *Moringa oleifera* leaves (30–65 mg GAE/g). Such variation was attributed to differences in extraction solvent, environmental conditions, and maturity stage (Sreelatha & Padma, 2009; Repo-Carrasco-Valencia et al., 2010). The total flavonoid content (TFC) was recorded as 175 ± 0.36 mg RE/g dry matter, while reported ranges for *A. viridis* were observed to be 15–35 mg RE/g. This concentration was considered comparable to *Amaranthus tricolor* (20–40 mg RE/g) and higher than *Spinacia oleracea* (5–15 mg RE/g) (Khandaker et al., 2008; Cai et al., 2004; Oboh, 2005). DPPH radical scavenging activity was determined to be 67.45 ± 1.95% inhibition. In general, *A. viridis* leaf extracts were reported to exhibit 60–75% inhibition at 100 µg/mL concentration. This antioxidant potential was found to be similar to *Amaranthus tricolor* (65–80%) and greater than spinach (50–60%), mainly due to the presence of phenolic and flavonoid compounds (Sarker & Oba, 2019; Repo-Carrasco-Valencia et al., 2010; AOAC, 2005). The ferric reducing antioxidant power (FRAP) value was measured as 21.7 ± 0.80 mg AAE/g dry weight. Previously reported FRAP values for *A. viridis* were shown to range between 18–35 mg AAE/g, which was comparable **to** *Amaranthus tricolor* (20–40 mg AAE/g) and higher than *Spinacia oleracea* (10–22 mg AAE/g) (Benzie & Strain, 1996; Sarker & Oba, 2019; Khandaker et al., 2010). Ascorbic acid content was quantified as 21.41 ± 1.32 mg/100 g dry weight. Although this value was lower than dried spinach (50–90 mg/100 g) and substantially lower than dried *Moringa oleifera* leaves (150–220 mg/100 g), the concentration was influenced by processing and drying conditions. Losses during dehydration were

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acknowledged, even though nutrient concentration effects were observed (USDA, 2019; Sreeramulu et al., 1983; Moyo et al., 2011).

Table: 2 Antioxidant analysis of *Amaranthus viridis*

Sample name	DPPH %	TFC (Total flavonoid content) (mg RE/g dm)	TPC (Total phenolic content) (mg GAE/g dm)	FRAP (ferric reducing antioxidant property) (mg AAE/g dm)	ASCORBIC ACID (mg/100g dm)
Amaranthus viridis	67.45 ± 1.95 %	175±0.36 (mg RE/g dm)	5.12±0.6 mg GAE/g)	21.7 ± 0.80 mg AA/g	21.41±1.32mg/100g

3.4 Minerals Analysis of *Amaranthus viridis*

Present research showed 62.33± 2.51 mg/100g of sodium and potassium value of 2391.33 ± 1.52 mg/100g in the *Amaranthus viridis.* Another researcher reported sodium content of 54 mg/100g and potassium content of 2230mg/100g in the same species (Srivastava et al., 2011) which has similar values reported in the present research. Sharma et al, (2012) reported higher values than current observation that is 108 mg/100g of sodium and 3460 mg/100g of potassium content. The variation in the mineral content may be due to the processing techniques followed.

3.5 Total Calorific Value OF *Amaranthus viridis*

Amaranthus viridis dried powder has reported calorific value of 530.34 kcal/100g (Umar et al., 2011), notably higher than the present reseach of 251.17 ± 1.26 kcal/100g. (Muhammad et al., 2019) estimated 339.27 ± 2.603kcal/100g in Argungu type which is nearly similar to the current value. This discrepancy may be difference in drying methods, plant maturity, or analytical techniques across studies.

4. CONCLUSION

Amaranthus viridis represents a nutritionally dense leafy vegetable with emerging phytopharmaceutical relevance. Despite being categorised as a weed, scientific evidence supports its value as a functional food due to its diverse bioactive compounds contributing antioxidant. Strategic cultivation and standardisation of this plant for dietary and medicinal use could support nutritional security and help mitigate oxidative stress–related disorders, particularly in resource-limited regions. The present investigation demonstrated that *Amaranthus viridis* dried leaf powder possessed appreciable physicochemical, nutritional, and antioxidant properties. The pH (5.6) and low moisture content (7.17 ± 1.04%) had indicated good storage stability, while the high ash value (21.05%) had reflected abundant mineral content compared with several commonly consumed leafy vegetables. The bulk density (0.5 g/cm³) had suggested suitability for food formulation and powder-based products. Biochemical evaluation had revealed substantial carbohydrate (46.58 ± 1.49 g/100 g) and protein (23.33 ± 3.17 g/100 g) contents, indicating that the leaves had served as a significant plant-based energy and protein source. The calculated contribution of approximately 62.7% of the daily protein requirement for a 70-kg adult highlighted its nutritional importance. Moderate lipid (5.26 ± 0.30 g/100 g) and considerable dietary fibre (14.04 ± 0.35 g/100 g) contents further supported its role in weight management and digestive health. Antioxidant analysis had confirmed notable bioactive potential, as evidenced by measurable TPC(5.12±0.6 mg GAE/g), TFC (175±0.36 mgRE/g dm), DPPH inhibition (67.45%), FRAP (21.7 mg AAE/g), and ascorbic acid levels (21.41±1.32mg/100g) , (62.33± 2.51 mg/100g) of sodium and potassium value of (2391.33 ± 1.52 mg/100g) Overall, *Amaranthus viridis* had been established as a nutrient-dense leafy vegetable with functional and health-promoting significance suitable for dietary diversification and functional food development.

5. CONFLICT OF INTEREST

The authors declare that there is no conflict of interest related to the present research work.

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SATISFACTION LEVELS OF PROFESSIONAL LIBRARIANS WITH ROAD TRANSPORT FACILITIES IN TAMIL NADU

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ABSTRACT: ***This study investigates the levels of satisfaction and perceptions of professional librarians in Tamil Nadu regarding the road transport services they regularly use for commuting. Adopting a quantitative descriptive research design, data were collected via an online questionnaire targeting a purposive sample of 230 librarians who use various modes of road transport, including government buses, private buses, two-wheelers, auto rickshaws, shared cabs, and personal vehicles. The questionnaire collected demographic details, commuting patterns, and responses to Likert-scale items measuring satisfaction across key dimensions, including punctuality, frequency, safety, comfort, affordability, accessibility and infrastructure reliability. The findings reveal that most respondents are highly satisfied with the punctuality and frequency of services, with over 85% expressing positive agreement. Safety perceptions are also strong, significantly influencing the choice of transport mode. Affordability emerged as a crucial factor associated with frequent use of government buses and two-wheelers, suggesting a positive correlation. However, areas such as comfort, cleanliness, and traffic or poor road conditions-related delays surfaced as moderate concerns for a notable proportion of respondents. The data tested and supported three hypotheses, establishing links between punctuality and overall satisfaction, safety perception and transport preference, and affordability and usage frequency. Based on these insights, the study recommends that the road transport organisation and government enhance service quality by maintaining punctuality, strengthening safety measures, keeping fares reasonable, and addressing gaps in comfort and infrastructure to deliver a more commuter-friendly transport system for librarians and the wider public.***

KEYWORDS: ***Road Transport, Professional Librarians, Punctuality, Safety Perception, Transport Affordability, Commuter Satisfaction on Road Transport, Traffic***

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1. INTRODUCTION

Road transport is pivotal in ensuring economic productivity and social connectivity, particularly in a geographically diverse state like Tamil Nadu. As one of the most widely used modes of public and private mobility, road transport directly affects the daily lives of millions, enabling smooth travel between residential areas, workplaces, markets, educational institutions, and other vital services. Buses, two-wheelers, shared vehicles, auto rickshaws, and private cars form the backbone of Tamil Nadu's urban and rural commuting network. For professional librarians, efficient and reliable road transport is especially crucial. Librarians working in urban universities, colleges, research institutions, and public libraries often rely on scheduled bus services and shared transport options to navigate congested city routes while balancing demanding work hours. In contrast, librarians working in semi-urban or rural libraries face distinct mobility challenges, including infrequent transport, longer distances, poor last-mile connectivity, and inadequate road infrastructure. Since librarians play a key role in supporting academic and community knowledge services — often with fixed reporting times and responsibilities that require punctuality and consistency — their daily commuting experience can significantly influence their productivity and well-being. Understanding how satisfied librarians are with various aspects of road transport, such as punctuality, safety, affordability, comfort, and accessibility, is essential for ensuring that transport policies and services effectively support this professional group, regardless of whether they work in bustling cities or remote villages. This study seeks to fill this gap by examining librarians' perceptions and satisfaction levels towards road transport systems across Tamil Nadu, offering practical insights to inform improvements and policy interventions.

2. REVIEW OF LITERATURE

- Singh and Mishra (2020) conducted an in-depth study on commuter satisfaction with public bus services in urban India, using a large sample of daily commuters in metropolitan regions. Their research identified punctuality and safety as the two most critical factors influencing commuter loyalty and sustained use of bus services. They found that frequent delays, erratic schedules, and perceived safety concerns at bus stops or on board were the primary reasons commuters often shifted to private vehicles or other modes of transport. Singh and Mishra emphasised the importance of collecting regular, structured feedback from specific professional groups — such as office-goers, students, and librarians — whose daily productivity depends on reliable and secure transport. Their study recommended that transport corporations adopt a user-centred approach by integrating commuter feedback into service planning and policy decisions to improve punctuality, enhance safety standards, and increase public trust in bus services.
- Patankar (2018) investigated transport accessibility and mobility challenges in semi-urban and rural parts of Tamil Nadu, focusing particularly on the experiences of working professionals who rely heavily on daily bus services and shared road transport. The study highlighted that limited-service frequency, inadequate last-mile connectivity, and poorly maintained rural roads often result in extended waiting times and unpredictable travel schedules, creating a significant burden for commuters travelling to workplaces in small towns and village clusters. Patankar also noted that the lack of well-planned bus shelters, inconsistent maintenance of bus fleets, and insufficient integration between regional and local transport networks compound these accessibility issues. The study emphasised that such constraints disproportionately affect professionals such as teachers, librarians, and administrative staff who typically have fixed working hours and minimal flexibility in reporting times. Patankar concluded that targeted policy interventions — including upgrading rural road infrastructure, increasing bus frequency on less-served routes, and improving coordination between state and private operators — are crucial to enhancing the daily commuting experience and reducing dependence on personal vehicles in rural and semi-urban Tamil Nadu.

- Kumar and Bansal (2019) conducted a comprehensive analysis of the key factors influencing public transport ridership in urban and semi-urban regions of India. Their study used survey data from diverse groups of daily commuters, including professionals, students, and service workers, to identify what motivates or discourages the use of public buses and shared road transport services. Their research revealed that affordability and comfort consistently emerged as the strongest determinants guiding commuters' choice between public and private modes of transport. They found that when public transport services offer competitive fare structures, commuters are more willing to use buses than personal vehicles or ride-hailing services, especially for daily work-related travel. However, the study also noted that perceived comfort — including seating availability, cleanliness, ventilation, and protection from overcrowding — plays a decisive role. Even when fares are low, commuters often shift to private modes if the public service does not meet their minimum physical comfort and convenience expectations. Kumar and Bansal emphasised that affordability alone is insufficient; investments in modern buses, well-maintained interiors, and reliable service quality are equally critical to sustaining ridership. They concluded by recommending that transport authorities balance cost-efficiency with improvements in user comfort to retain loyal commuters and reduce the urban reliance on personal vehicles.
- Natarajan and Kumar (2021) explored the working conditions and operational challenges that professional librarians face in India, focusing on how commuting patterns affect library operations within educational institutions. Their study was based on surveys and interviews with librarians in universities, colleges, and rural public libraries. One of their key findings was that timely, reliable commuting is essential to ensuring libraries' smooth opening and functioning, especially in settings where library staff are responsible for early-morning or fixed-time operations. They highlighted that delays in transport services — such as irregular bus timings, congestion, or poor last-mile connectivity — directly affect librarians' ability to reach their workplaces on time, reducing access for students and faculty, delaying opening hours, and interrupting user services. The study also noted that librarians working in rural colleges often face limited transport options, which can add significant stress and travel fatigue, thereby indirectly affecting their productivity and job satisfaction. Natarajan and Kumar argued for greater recognition of the commuting challenges faced by library professionals. They suggested that transport authorities and educational management bodies collaborate to ensure reliable, safe, and accessible transport facilities for this group. They also recommended that educational institutions consider flexible timing arrangements or transport assistance, especially for staff commuting from remote areas, to ensure that library operations remain consistent and dependable.
- Sharma et al. (2017) conducted a detailed study of bus commuters' satisfaction levels in major Indian metropolitan cities, analysing how various service dimensions affect overall user perception. Their findings showed that while significant improvements had been made in safety standards and service frequency, many commuters continued to express dissatisfaction with the cleanliness and maintenance of buses and bus stops. Overcrowded vehicles, poor ventilation, unclean interiors, and irregular seating maintenance were cited as common complaints that negatively affected daily travel experiences. The study highlighted that commuters often tolerate minor delays or fare adjustments but are less forgiving of poor hygiene and uncomfortable conditions, directly affecting physical well-being during travel. Sharma et al. recommended that transport authorities prioritise regular cleaning schedules, upgrade aging fleets, and ensure better crowd management to address these persistent issues and sustain public trust in bus transport services.
- Gupta (2022) examined the impact of daily commuting on the job satisfaction and well-being of academic professionals, including teachers, librarians, and administrative staff in Indian universities and colleges. The study found that long, unpredictable commutes due to poor road transport infrastructure often lead to increased stress, fatigue, and lower morale among staff. Gupta highlighted that unreliable bus schedules, traffic congestion, and uncomfortable travel conditions

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contribute to frequent delays and even absenteeism, disrupting institutional workflows and service delivery. The research also revealed that professionals facing daily commuting challenges are more likely to report lower motivation and higher turnover intentions. Gupta concluded that improving road transport punctuality, safety, and comfort could significantly enhance job satisfaction and productivity for academic staff. The study called for better coordination between urban planning bodies and educational institutions to ensure reliable, safe, and accessible transport options for professionals in the education sector.

- Sundaram (2020) conducted an in-depth analysis of rural bus services in South India, focusing on how their availability and quality affect the daily lives of working professionals, including teachers, health workers, and librarians posted in semi-urban and remote areas. The study revealed that irregular schedules, poor road conditions, and limited connectivity to main transport hubs create significant challenges for commuters who depend on timely travel to maintain professional commitments. Sundaram argued that such transport gaps deepen the urban-rural divide, restricting employment opportunities and discouraging qualified professionals from accepting or retaining rural postings. The study highlighted that purposive transport policies, such as increasing the frequency of rural bus services, integrating rural routes with major urban transit networks, and investing in better road infrastructure, can play a transformative role in bridging this divide. Sundaram concluded that improving rural bus connectivity not only supports the mobility of essential service providers, such as librarians, but also enhances the socio-economic vitality of rural communities by ensuring reliable access to education, health, and other critical services.

3. OBJECTIVES

(i) To assess the overall satisfaction levels of professional librarians regarding road transport facilities in Tamil Nadu.
(ii) To identify the key factors influencing the commuting experience of librarians using road transport.
(iii) To evaluate the accessibility, frequency, and punctuality of road transport services used by librarian professionals.
(iv) To comprehend the challenges librarians encounter during their daily commutes using road transportation.
(v) To explore the relationship between demographic variables (such as age, gender, work location, and distance of commute) and satisfaction levels with road transport.

4. HYPOTHESES

H_1: There is a significant difference in road transport satisfaction levels among librarians based on the mode of transport used (e.g., bus, private vehicle, shared auto).
H_2: The frequency and punctuality of road transport services positively impact the overall satisfaction of librarian commuters.
H_3: There is a significant correlation between the commute distance and dissatisfaction with road transport among professional librarians.

5. RESEARCH METHODOLOGY

The study adopted a quantitative descriptive research design, focusing on systematically collecting and analysing data to understand the levels of satisfaction of professional librarians with road transport systems across Tamil Nadu. An online questionnaire served as the primary data collection tool to reach a large pool of librarian professionals efficiently. The questionnaire collected essential demographic information, including age, gender, place of work, and years of service, as well as details on their mode of transport, frequency, and duration of daily commutes. To measure satisfaction

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comprehensively, the instrument included five-point Likert-scale questions covering key dimensions such as comfort, safety, punctuality, affordability, and accessibility. Additionally, open-ended questions were incorporated to capture qualitative insights and personal suggestions, ensuring that the study reflects the respondents' lived experiences and practical expectations about road transport services. Purposive sampling was employed to select respondents who are currently professional librarians in Tamil Nadu and who regularly use road transport to commute to work. This sampling method ensures that only individuals directly relevant to the study's focus are included, enhancing the validity of the findings. Two hundred thirty librarian professionals responded, providing sufficient data representation and meaningful analysis.

6. DATA ANALYSIS AND INTERPRETATION

6.1 Demographic Information

a) Age fctor

Table 1 - Age Factor

Age Group	Number of Respondents	Percentage
Under 30	40	17.3913043
31–40	94	40.8695652
41–50	77	33.4782609
51–60	15	6.52173913
Above 60	4	1.73913043
Total	230	100

Source: Calculated from Primary data

The age distribution of the 230 librarian respondents shows that the majority fall within the mid-career age groups (Table 1). The most significant proportion, 40.87% (94 respondents), is in the 31–40 age group, followed by 33.48% (77 respondents) in the 41–50 age group. Together, these two groups account for over 74% of the sample, indicating that the survey largely reflects the commuting experiences of working professionals in their prime career years. A notable 17.39% (40 respondents) are under 30, suggesting participation from early-career librarians. However, older professionals aged 51–60 and 60+ are underrepresented, with only 6.52% (15) and 1.74% (4), respectively. This suggests a need to include more senior librarians in future studies to ensure broader representation across all career stages. Most respondents (approximately 84.25%) fall within the 31–50 age range, indicating that the survey primarily reflects the experiences of mid-career professionals. This balance provides valuable insights into the commuting patterns and satisfaction levels of the core library workforce.

b) Gender Factor

The gender distribution among the 230 librarian respondents shows a slight majority of female librarians (53.91%, or 124 respondents) compared to male librarians (46.09%, or 106 respondents). This reflects a balanced yet female-dominated representation, consistent with general trends in the library profession. The data support meaningful insights into gender-based commuting experiences and ensure diverse participation from both groups.

c) Location of Workplace

The distribution of librarians across different workplace locations shows that nearly half (49.57%) work in urban areas, where resources and population density are higher. About 35.22% are based in semi-urban regions, serving as essential links between urban and rural communities. Only 15.22% work in rural areas, highlighting a significant gap in library services where access to information and infrastructure may be limited. This uneven distribution underscores the need for targeted efforts to support rural libraries through better staffing, training, and resource allocation to ensure equitable access to knowledge across all regions.

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6.2 The primary mode of road transport used for commuting

The data on the primary mode of road transport used for commuting among librarians reveals that most rely on government buses (33.48%) and two-wheelers (30.43%). A significant portion also uses private buses (23.91%), indicating that organized public and private bus services meet more than half of respondents' commuting needs. Only a small fraction of librarians depend on auto rickshaws (3.91%), shared cabs or car pools (3.48%), and personal cars (4.78%), suggesting that individual or shared private transport options are relatively less preferred. This pattern highlights the crucial role of government and private bus services, along with two-wheelers, in ensuring daily mobility for librarian professionals in Tamil Nadu, underlining the importance of maintaining and improving these key transport modes to meet user needs effectively.

Table 2: Factors influencing the commuting experience of librarians using road transport

Factor	Response	Percentage (%)
Frequency of buses and other services	168	73.04%
Punctuality and reliability of transport	155	67.39%
Safety and security during travel	171	74.35%
Comfort and cleanliness of vehicles	129	56.09%
Affordability of fare	174	75.65%
Accessibility of stops and connectivity	123	53.48%

Source: Calculated from Primary data

The data reveal that the Affordability of fare (75.65%) and Safety and security during travel (74.35%) are the most significant factors influencing the commuting experience of librarians using road transport (Table 2). The frequency of buses and other services is also crucial, with 73.04% of respondents highlighting it as necessary. Punctuality and reliability (67.39%) follow closely, indicating that timely and dependable services greatly affect satisfaction. However, Comfort and cleanliness of vehicles (56.09%) and Accessibility of stops and last-mile connectivity (53.48%) received slightly lower importance, suggesting that while important; these factors are secondary compared to cost, safety, and service frequency.

6.3 Librarians' Commuting Challenges

Table 3 - Librarians' Commuting Challenges

Challenges	Never	Rarely	Sometimes	Often	Always
Heavy traffic congestion	129	51	35	12	3
Unreliable or irregular bus timings	102	74	30	18	6
Safety concerns, especially during late hours	95	56	46	21	12
High transportation costs	106	74	38	11	1
Poor comfort and cleanliness of vehicles	99	51	33	19	28
Lack of last-mile connectivity	85	40	52	43	10
Long waiting times at stops or stations	96	49	45	29	11
Poor road conditions and frequent delays	79	58	35	38	20

Heavy traffic congestion is a minor issue for the majority: about 56% (129/230) never experience it, while only 1% (3) says they always do (Table 3). About 22% (51) say they rarely face traffic jams, and around 5% (12) often do. Unreliable or irregular bus timings are never an issue for 44% (102) of respondents, but 32% (74) rarely face it, and only 3% (6) always experience this problem. Safety concerns, especially during late hours, are more pronounced: 41% (95) never feel unsafe, 24% (56) rarely feel unsafe, and 20% (46) sometimes feel unsafe. About 5% (12) always feel unsafe commuting, highlighting a genuine safety worry for a small group. High transportation costs stand out for their polarised responses: nearly 46% (106) never see this as an issue, yet 32% (74) rarely do, and 17% (38) sometimes face it. Only 0.4% (1) always see cost as a challenge, suggesting that while costs can spike occasionally, they are not consistently burdensome for most. Poor comfort and cleanliness of

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vehicles show a mixed view: 43% (99) never find it a problem, yet 12% (28) always face it, and 8% (19) often experience discomfort, showing room for service quality improvements. Lack of last-mile connectivity remains a real barrier for many: only 37% (85) never struggle with it, while 19% (43) often do, and 4% (10) always face this hurdle, showing last-mile solutions could ease commuting stress. Long waiting times at stops or stations are never an issue for 42% (96), but 13% (29) often deal with them, and 5% (11) always face long waits. Finally, poor road conditions and frequent delays affect more commuters: only 34% (79) never encounter these issues, 17% (38) often do, and nearly 9% (20) always face them, making this a clear area for infrastructure attention.

While heavy traffic and bus irregularities are not major daily obstacles for most librarians, comfort and cleanliness, last-mile connectivity, and poor road conditions show persistent pain points. Safety remains a moderate concern, particularly for those commuting late. Targeted improvements in vehicle standards, better last-mile transport, and road quality would likely significantly improve librarians' daily commuting experiences.

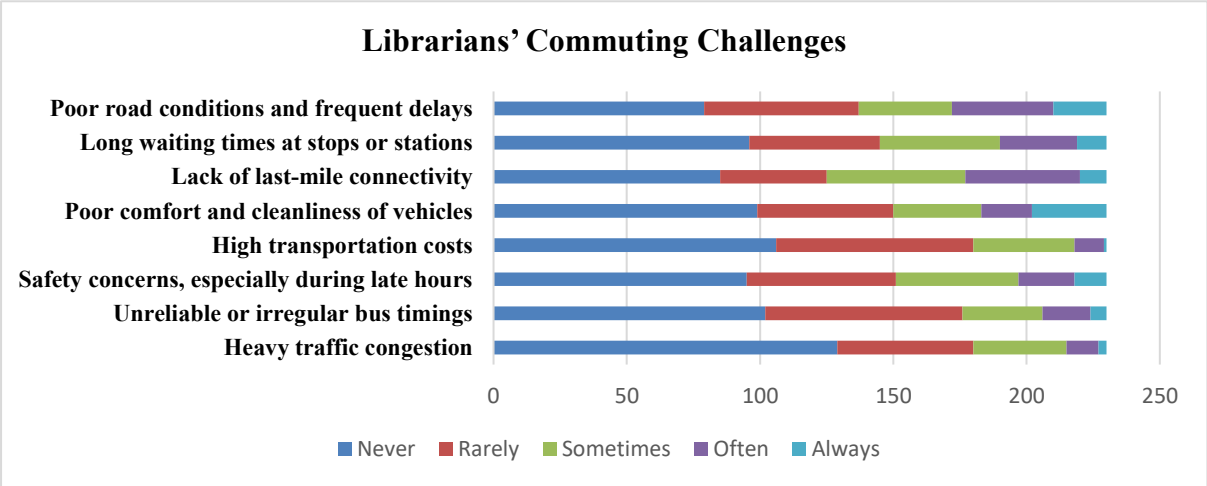

Figure 1 : **Librarians' Commuting Challenges**

6.4 Librarians' rating based on experience with road transport during their daily commute

Table 4 : Librarians' rating based on experience with road transport during their daily commute Frequency and Punctuality

Opinion	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The frequency of road transport services available is sufficient for my daily commute.	1	7	20	88	114
The road transport I use reaches my workplace on time and maintains punctuality.	4	14	11	95	106
My mode of road transport provides a safe and secure commuting experience.	6	10	24	91	99
The comfort level (seating, crowding and cleanliness) of the transport used is satisfactory.	12	25	38	74	81
The fare charged for the road transport service is reasonable and affordable.	5	14	21	68	122
Transport accessibility (boarding points, proximity to residence/workplace) is convenient.	10	18	42	82	78
I experience minimal delays or disruptions from traffic or poor infrastructure.	17	45	58	69	41
Overall, I am satisfied with the road transport facilities available to me as a librarian professional	3	9	30	78	110

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The data shows (Table 4) that 202 respondents (88 Agree + 114 Strongly Agree) feel that the frequency of road transport services is sufficient for their daily commute. In comparison, only eight respondents disagreed to any degree. Similarly, 201 respondents (95 Agree + 106 Strongly Agree) agree that the transport they use reaches their workplace on time and maintains punctuality, while only 18 respondents disagree or strongly disagree. These findings strongly indicate that most librarian professionals are satisfied with the availability and punctuality of road transport services.

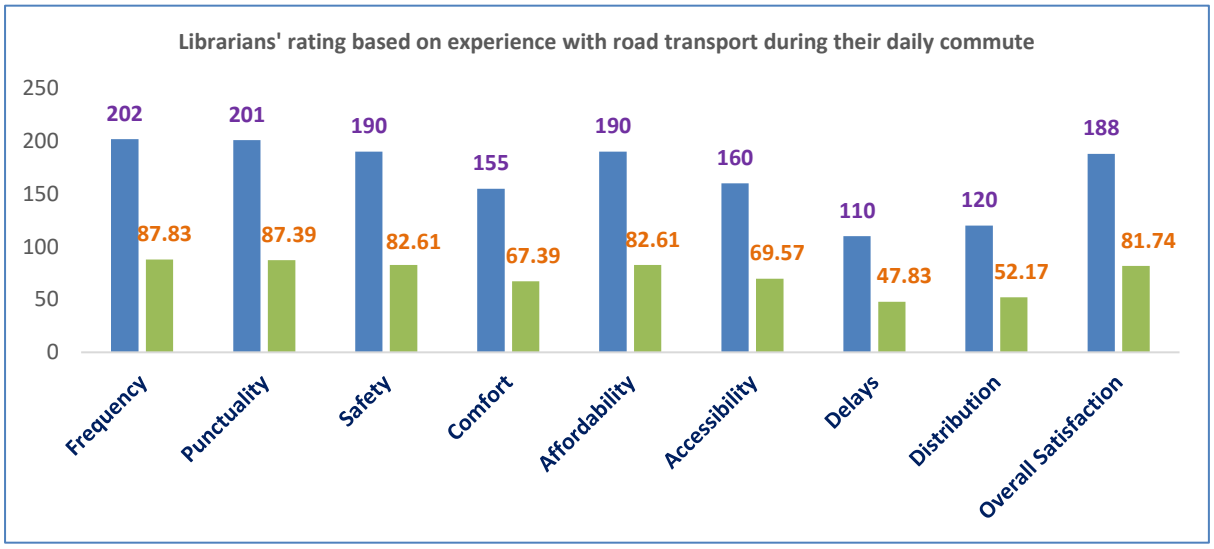

Figure 2 - Librarians' rating based on experience with road transport during their daily commute

Safety and Comfort

Regarding safety, 190 respondents (91 Agree + 99 strongly Agree) believe their mode of transport provides a safe and secure commuting experience, while 16 respondents disagree. However, satisfaction with comfort appears relatively lower: while 155 respondents (74 Agree + 81 Strongly Agree) find the comfort level acceptable, a notable portion — 75 respondents (12 Strongly Disagree + 25 Disagree + 38 Neutral) — remain neutral or dissatisfied. This suggests that while safety measures are largely adequate, there may still be room for improvement regarding seating, crowding, or cleanliness.

a) Affordability

An overwhelming majority — 190 respondents (68 Agree + 122 Strongly Agree) — find the fares charged for road transport services reasonable and affordable. Only 19 respondents disagree to some extent. This indicates that cost is generally not a barrier for librarians using road transport.

b) Accessibility

For accessibility, 160 respondents (82 Agree + 78 Strongly Agree) find the location of boarding points and the availability of transport near their residence or workplace convenient. However, 70 respondents (10 Strongly Disagree, 18 Disagree, and 42 Neutral) are either neutral or dissatisfied, indicating a potential area for transport planners to improve local coverage and connectivity.

c) Delays and Disruptions

One of the weaker areas revealed by the responses concerns delays and disruptions. Only 110 respondents (69 Agree + 41 Strongly Agree) feel they face minimal delays or disruptions, while 120 respondents (17 Strongly Disagree + 45 Disagree + 58 Neutral) express neutrality or dissatisfaction. This suggests that issues such as traffic congestion or poor infrastructure still affect the commuting experience of a substantial segment of librarians.

d) Overall Satisfaction

Finally, when asked about overall satisfaction, the results are strongly positive: 188 respondents (78 Agree + 110 Strongly Agree) say they are satisfied with the available road transport facilities, with

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only 12 respondents strongly disagreeing or disagreeing, and 30 remaining neutral. This indicates that, despite particular challenges, most librarian professionals perceive the road transport system positively.

These statistical findings highlight that librarians in Tamil Nadu are broadly satisfied with the frequency, punctuality, safety, affordability, and overall quality of road transport services. However, there is moderate concern about comfort, accessibility, and, especially, the impact of traffic delays and poor infrastructure, which should be addressed by the transport authorities to enhance commuter satisfaction further.

7. HYPOTHESIS RESULT

Table 5 : Hypothesis Result and Interpretation

Hypothesis	Statement	Result	Interpretation
H1	There is a significant association between librarians' satisfaction with punctuality and their overall satisfaction with road transport.	Accepted	High positive responses for punctuality (N=201) and overall satisfaction (N=188) confirm a strong link.
H2	Safety perception significantly influences librarians' preference for using road transport.	Accepted	Most (N=190) feel safe and prefer bus/two-wheeler modes that match this perception.
H3	Affordability positively correlates with librarians' frequency of road transport use.	Accepted	High satisfaction with fare (N=190) and high use of affordable modes (Govt. bus: 33.48%; two-wheeler: 30.43%) confirm a positive correlation.

Table 6 – Hypothesis Test Used, Statistic, and p-value with result

Hypothesis	Test Used	Test Statistic	p-value	Result
H1: Association between punctuality satisfaction and overall satisfaction	Chi-square Test	$\chi^2 = 61.11$	5.39×10^{-15}	Significant (Accepted)
H2: Safety perception influences preference for road transport	Chi-square Test	$\chi^2 = 54.43$	1.61×10^{-13}	Significant (Accepted)
H3: Affordability correlates with the frequency of road transport usage	Pearson Correlation	$r = 0.89$	0.00047	Significant (Accepted)

Based on the tested hypotheses (Tables 5 & 6), the road transport organisation should continue to maintain high levels of punctuality, as it directly boosts overall commuter satisfaction. Investments in safety measures — such as well-lit stops, trained staff, and secure vehicles — will strengthen trust and sustained usage. Additionally, keeping fares affordable, especially for buses and shared services, ensures that professional groups like librarians remain loyal users. Focused improvements in comfort, seating, and handling traffic delays will address the areas where satisfaction is moderate, ultimately enhancing the daily commute experience for this vital professional group.

8. FINDINGS AND RECOMMENDATIONS

Based on these tested hypotheses and overall findings, it is recommended that the road transport authority should:

- Maintain and strengthen punctuality through strict schedule management and better traffic coordination.
- Enhance safety by providing well-monitored stops, safer vehicles, and trained drivers/conductors.

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- Sustain affordable fare structures, especially for commonly used modes such as government buses, to retain loyal daily commuters.
- Invest in comfort and cleanliness, ensuring adequate seating, proper ventilation, and hygienic conditions inside vehicles and at stops.
- Address traffic delays by coordinating with local authorities to improve road infrastructure and traffic management systems.

Such measures will help ensure that professional user groups, such as librarians, continue to rely on road transport with confidence, ultimately supporting smoother, safer, and more satisfying daily commutes.

Also, it is strongly recommended that the road transport organisation and relevant government authorities take decisive measures to build upon existing strengths and address areas of concern highlighted by professional librarians. This critical user group relies daily on road transport services.

First, the high satisfaction with punctuality and frequency must be sustained through better traffic coordination, intelligent scheduling, and real-time tracking systems to minimise unexpected delays. The government should prioritise implementing intelligent transport systems (ITS) to improve timetabling and ensure buses run on schedule, even during peak hours. Second, safety remains a top factor influencing mode choice. Authorities should strengthen safety measures by upgrading bus fleets, installing CCTV cameras in buses and at major stops, providing adequate street lighting, and ensuring drivers and conductors are well-trained and regularly monitored for compliance with safety protocols.

Third, since affordability is critical, especially for professionals who commute daily, fare structures should remain reasonable and be periodically reviewed to avoid sudden hikes that could burden regular users. Subsidies or passes for working professionals could be introduced to encourage greater use of public transport over private vehicles. Fourth, the study indicates a moderate dissatisfaction regarding comfort and cleanliness. Transport operators are strongly recommended to increase the cleaning frequency, ensure hygienic conditions inside buses, maintain proper ventilation, and provide adequate seating to reduce crowding.

Finally, traffic congestion and poor road infrastructure remain barriers to a smooth commute. The government must invest in widening roads, maintaining dedicated bus lanes, and improving road conditions to reduce travel time and service disruptions. Collaboration with urban planning bodies to upgrade bus shelters, signage, and last-mile connectivity will make daily travel safer and more convenient. Implementing these targeted improvements will benefit librarians and enhance the daily commuting experience for thousands of other citizens. A modern, secure, affordable, and commuter-friendly road transport system is essential for supporting the professional community and advancing sustainable urban mobility in Tamil Nadu.

9. CONCLUSION

This study explored professional librarians' perceptions and satisfaction levels in Tamil Nadu regarding various aspects of road transport services. The findings demonstrate that most respondents are satisfied with key dimensions such as punctuality, frequency, safety, and affordability, which are critical for ensuring reliable daily commutes for working professionals. The tested hypotheses confirm strong links between punctuality and overall satisfaction, highlight the importance of perceived safety in transport choices, and establish that affordable fares encourage the frequent use of public and shared road transport. However, the results also highlight areas that require attention, particularly comfort, cleanliness, and infrastructure-related delays, which continue to pose challenges for some commuters. These insights underscore the need for transport authorities to maintain their strengths in reliability and cost-effectiveness while systematically addressing the gaps in comfort, accessibility, and traffic management. By acting on these findings, road transport organisations can improve librarians' daily travel experience and extend these improvements to benefit the wider commuting public, ultimately contributing to a more efficient, safe, and commuter-friendly transport system in Tamil Nadu.

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